
STEEL
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FRASSE

STEELS

STEEL WORKS OF PETER A. FRASSE & CO., INC., AT HARTFORD, CONN.

FRASSE-ELECTRIC

AND OPEN HEARTH

STEELS

Established 1816

PETER A. FRASSE & CO., Inc.

417-421 CANAL STREET

NEW YORK

PHILADELPHIA *Branches* BUFFALO

WORKS: HARTFORD, CONN.

NEW YORK PHILADELPHIA BUFFALO HARTFORD

CONTENTS

Philadelphia Office
and Warehouse
625 Arch St.

Main Offices
and Warehouse

417-421 Canal St.
New York

Buffalo Office
and Warehouse
50-52 Exchange St.

Foreword

ONE hundred years of successful business activity is the enviable record borne by the firm of Peter A. Frasse & Co., Inc. The growth of the company's business has been synonymous with the growth and development of the machine tool industry in America.

Its long and successful career, devoted exclusively to the steel industry and allied lines, has been productive of much valuable and interesting data relating to steel of superior qualities.

The policy of the company today, as it was in its early days, is to offer to the trade only those grades of products which will render the most efficient and maximum service obtainable.

The remarkable development which has taken place in the manufacture of tool steels and alloy construction steels, produced in recent years, is strongly emphasized in the Frasse-Electric Steels, which are second to none in quality and absolute uniformity.

The facilities of the company have been considerably increased by the addition of the new Frasse-Electric Steel Works in Hartford, Conn., which are completely equipped in every detail with modern machinery and appliances.

The operation of the works is under the supervision of experienced metallurgists, and all products are subject to rigid inspection.

A competent Engineering Department is maintained, and is prepared to furnish expert advice and co-operate with concerns desirous of obtaining greater manufacturing efficiency and economy through the use of Frasse-Electric Steels.

The improved facilities enable us to furnish a complete line of Frasse Steels in the raw, semi-finished or finished state, in either large or small quantities, on short notice, thus maintaining the high standard of Frasse "Quality-Service."

To those in the trade who are not yet familiar with the unusual merits and advantages possessed by the Frasse-Electric Steels in fulfilling the most exacting requirements, we ask the opportunity to demonstrate our claims, with the assurance of courteous and fair treatment at all times.

Frasse-Electric Steel Works

The Frasse-Electric Steel Works (at Hartford, Conn.) were built and put in operation in 1916. The selection of Hartford as the location of the Steel Works is of especial importance and great advantage to the many large manufacturing industries of Western New England, and has the additional advantage of being within easy reach of the company's warehouses in New York, Philadelphia and Buffalo.

Every modern improvement in building construction, machinery, appliances and methods of operating has been incorporated with the view of obtaining the best working conditions possible, and promoting the best interests of our present and prospective customers.

With ample railroad sidings and extensive loading and unloading platforms, the works, situated close to the tracks of the New York, New Haven and Hartford Railroad, with the added convenience of a waterway within easy distance, have unexcelled shipping facilities.

The equipment includes the latest improved type of furnaces, oil and lead baths, quenching, annealing, case-hardening and pickling apparatus, and the most recently developed machinery for cold-drawing of steel in various forms and shapes. There is also equipment for straightening, turning, polishing, cutting and handling of its products. The complete equipment of the works is operated and controlled by electricity.

General Information

We respectfully direct our customers' attention to the following:—

Terms

Net cash 30 days, unless otherwise agreed.

Prices

Prices are subject to change without notice.

Extras

Extra charges for size, annealing and cutting to specified length will be made in accordance with standard lists shown in this catalague. Boxing, casing and other special packing at cost.

Sales

Sales and contracts of sale are accepted with the understanding that strikes, accidents, fires and other causes beyond our control shall relieve us of prompt fulfillment of orders.

Contracts

All contracts must be accepted by an officer of the company.

Warranty

We will replace any steel found defective in first hands when used for the purposes stated in customers' orders, but we do not assume liability for customers' labor or damage costs.

FRASSE-ELECTRIC TOOL STEELS

Frasse-Electric Tool Steel

The electric furnace process of manufacturing high carbon tool steel secures the highest degree of uniformity of chemical elements and physical properties. Grades A, B, C and D are electric furnace products and are the development of long and careful research, which has produced qualities most suitable for the entire range of tool steel uses, of which only a partial list can be given under each caption.

The following grades of high carbon tool steel, with the exception of the octagon drill steel, unless otherwise specified, are furnished hot rolled, annealed and machine straightened.

We also furnish tool steel as follows:

Unannealed Bars
Annealed and Turned Bars
Annealed and Cold Drawn Bars
Annealed, Turned and Polished Bars
Billets
Slabs
Plates

Grade A

Extra Quality: Hard Temper

For all tools requiring a keen cutting edge combined with great hardness, such as

Bits
Broaches, small
Chasers
Engravers' Tools
Files
Lathe Tools
Magnets
Milling Cutters
Planer Tools
Reamers
Scrapers
Screw Cutting Dies
Surgical Instruments
Taps
Twist Drills
Watchmakers' Tools
Wire Drawing Dies
Woodworking Chisels
Woodworking Tools
Etc.

Weld: not weldable.
Forge: light cherry—1455/1500° F.—790/815° C.
Anneal at medium cherry—1390/1410° F.—755/765° C.
Harden: medium cherry—1375/1435° F.—746/780° C.

Grade B

Extra Quality: Medium Hard Temper

This temper is most universally used for general shop requirements, and is suitable for

Ball Bearings
Blanking Dies
Broaches
Chisels
Cold Cutting Dies
Cups
Cutter Plates
Drawing Dies
Flat Jacks and Forcers
Gin Saws
Hubs
Jewelers' Arbors
Knife Blades
Lathe Tools
Metal Working Stamps, small
Milling Cutters
Pivots
Planer Tools
Plating for Shear Blades
Plating for Machine Knives
Punches
Reamers
Rolls
Screw Cutting Dies
Scythe Edges
Silversmiths' Dies
Silver Spoon Dies
Skates
Swedging Rolls
Taps
Threading Dies
Trimming Dies
Twist Drills
Woodworking Knives
Woodworking Tools
Etc.

And for all dies which do not strike sudden blows.

Weld: weldable.
Forge: light cherry—1475/1515° F.—800/825° C.
Anneal at medium cherry—1390/1410° F.—755/765° C.
Harden: medium cherry—1375/1450° F.—746/788° C.

Grade C

Extra Quality: Tough Hard Temper

For tools requiring a hard surface combined with tenacity, such as

Beading Tools
Blacksmiths' Tools
Bolt Machine Dies
Broaches
Bush Hammers
Chipping Chisels
Chuck Jaws
Cold Chisels, hand
Cold Heading Dies
Cold Saws
Dies, large
Forcers, large
Hammer Faces
Hard Hand Chisels
Hot Punches
Hot Sets
Knife Blades
Lathe Centers
Mandrels
Metal Marking Stamps, large
Pliers
Plungers
Pneumatic Chisels
Punches, large
Reamers, large
Screw Plates
Scythe Edges
Shear Blades
Silver Spoon Dies
Stamps
Taps, large
Tongs
Trimming Dies
Vise Jaws
Woodworking Tools
Etc.

We can also furnish octagon drill steel, made of same grade and temper, suitable for rock, mining and quarry drills, etc.

Weld: weldable.
Forge: light cherry to dark orange—1490/1535° F.—810/835° C.
Anneal at medium cherry—1390/1410° F.—755/765° C.
Harden: medium to light cherry—1385/1470° F.—752/799° C.

Grade D

Extra Quality; Tough Temper

A strong, tough steel for tools subjected to severe shocks, such as

Blacksmiths' Tools	Pinch Bars
Chisels	Pivot Journals
Circular Wood Saws	Punches, large
Cold Stamping Dies	Rock Drills
Drop Forging Dies	Sets
Flatters	Shear Blades, large
Hammers	Sledges
Jaws	Snaps
Piercing Dies, large	Springs, Etc.

And for welding to large surfaces.

Weld: readily.
Forge: light cherry to dark orange—1510/1555° F.—820/845° C.
Anneal at medium cherry—1390/1410° F.—755/765° C.
Harden: light cherry—1410/1490° F.—765/810° C.

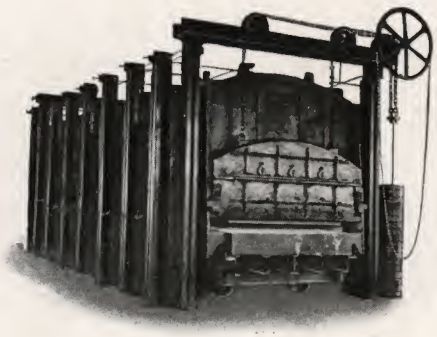
Grade E

Kronos Extra Tool Steel

A lower priced but very reliable steel suitable for

- Axes
- Chisels
- Chuck Jaws
- Cup Tools
- Dies
- Edge Tools
- Hammers
- Mill Picks
- Mining Drills
- Punches
- Reamers
- Rock Drills
- Sets
- Sledges
- Switch Tools
- Taps
- Track Tools
- Etc.

Weld: weldable.
Forge: light cherry—1475/1515° F.—800/825° C.
Anneal at medium cherry—1390/1410° F.—755/765° C.
Harden: medium cherry—1375/1450° F.—746/788° C.



FRASSE-ELECTRIC ALLOY TOOL STEELS

Frasse-Electric Alloy Tool Steel

These high grade alloy tool steels have been scientifically developed with proper proportioning and careful blending of the various alloys, making them pre-eminent in meeting successfully very severe and unusual conditions. They are the highest attainment of the steel maker's science, and for efficiency and performance they are unapproachable in the class of work for which they are especially manufactured.

Grade I

Extra Special: Very Hard Steel

This is our very best grade of alloy tool steel and strongly recommended for tools requiring a cutting edge of particularly lasting qualities, such as tools and drills for boring cylinders and cannon barrels, including

Bits	Screw Taps
Milling Cutters	Shaping Tools
Milling Tools	Slotting Tools
Planing Tools	Taps
Reamers	Turning Tools
Rifling Tools	Twist Drills
Screw Cutting Tools	Etc.

and for working hard materials at a moderate rate of speed.

Weld: not weldable.
Forge: dark to light orange—1560/1740° F.—850/950° C.
Harden: light cherry to dark orange—1470/1540° F.—800/840° C.

Grade H

Special X Quality

This is a new alloy steel especially manufactured for hard cutting tools where it is essential that no change of dimensions or distortion occur upon hardening

Long Taps	Screw Dies
Milling Cutters	Taps
Milling Tools	Thread Cutting Dies
Piercing Dies	Twist Drills
Reamers	Etc.

and tools which are required to stand severe twisting strains and hold their cutting edges.

Weld: not weldable.
Forge: not recommended to be forged.
Harden: light cherry—1435/1470° F.—780/800° C.

Grade F

Special Medium Hard Steel

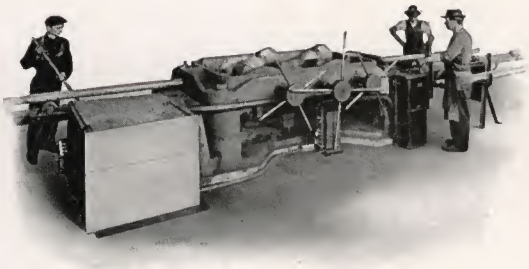
For tools where it is essential that no change in shape or dimensions occur during hardening, such as

File Chisels	Reamers
Hard Screw Dies	Ring Gauges
Hobs	Screw Plates
Milling Cutters	Taps
Milling Tools	Threading Dies
Piercing Dies	Twist Drills
Plug Gauges	Etc.

Weld: not weldable.

Forge: only reforge when absolutely necessary at dark to medium orange—1525/1615° F.—830/880° C.

Harden: light cherry—1435/1470° F.—780/800° C.



HIGH SPEED TOOL STEELS

High Speed Steel

Our well known Maximum and Diamond Extra brands represent the latest and highest development of high speed steels. The Maximum brand in particular has proven repeatedly that it is the very best high speed steel to be obtained, and possesses special advantages in that it excels in cutting at an extremely high rate of speed.

Grade M

Maximum High Speed Steel

For very severe requirements in rapid machining of all materials, including the hardest. The fast cutting ability of this brand is limited only to the power and capacity of the machinery of the factory. It is absolutely uniform and is especially suitable for cutting hard steel, hard grey castings, hard cast iron, nickel and chrome nickel steels.

Weld: not weldable.
Forge: light yellow—1850/2010° F.—1010/1100° C.
Harden: white—2260/2340° F.—1240/1280° C.

Grade L

Diamond Extra High Speed Steel

For use where the product manufactured does not permit the employment of steel adapted to the highest speed work and where the cost of the steel used is an item to be taken into consideration. It is recommended for

Drills	Shaping Tools
Cutting Tools	Taps
Milling Cutters	Turning Tools
Planing Tools	Etc.

Weld: not weldable.
Forge: light yellow—1850/2010° F.—1010/1100° C.
Harden: white—2260/2340° F.—1240/1280° C.

High Speed Tool Holder Bits
(Treated)

These bits are made of Maximum and Diamond Extra High Speed Steel, and are furnished cut to lengths, bevelled, straight and heat-treated. Special sizes and lengths hardened to order on short notice.

Stock Sizes on Hand

Square	Square
1/4" x 2 1/2" long	1/2" x 4" long
5/16" x 2 1/2" long	5/8" x 4 1/2" long
3/8" x 3" long	3/4" x 5" long
7/16" x 3 1/2" long	

QUALITY PAF SERVICE

High Speed Steel

Standard Classification of Extras

ROUNDS, SQUARES AND OCTAGONS

	Extra cents per lb.
5/8″ to 2″	base
2 1/16″ to 2 1/2″	2
2 5/8″ to 3″	2 1/2
3 1/16″ to 3 1/2″	3
3 5/8″ to 4″	3 1/2
4 1/16″ to 4 1/2″	4
4 5/8″ to 5″	4 1/2
5 1/16″ to 5 1/2″	5
5 5/8″ to 6″	5 1/2
6 1/16″ to 6 1/2″	6
6 5/8″ to 7″	6 1/2

	Extra cents per lb.
9/16″ to 1/2″	2
7/16″ to 3/8″	3 1/2
5/16″ to 11/32″	6
1/4″ to 9/32″	8 1/2

FLATS

5/8″ to 2″x5/8″ to 2″	base
1/8″x3/16″	40
1/8″x1/4″	30
1/8″x5/16″	20
1/8″x 3/8″ to 2″	14
3/16″x 1/4″ to 3″	14
1/4″x 5/16″ to 1/2″	8
1/4″x 5/8″ to 1″	5
1/4″x1 1/8″ to 4″	3
5/16″x 3/8″ to 5/8″	5
5/16″x 3/4″ to 1″	3 1/2
5/16″x1 1/8″ to 4 1/2″	3
3/8″x 7/16″ to 3/4″	3
3/8″x 7/8″ to 1 1/2″	3
3/8″x1 5/8″ to 5″	2 1/2
7/16″x 1/2″ to 1″	3
7/16″x1 1/8″ to 5 1/2″	2 1/2
1/2″x 5/8″ to 1″	2 1/2
1/2″x1 1/8″ to 6″	2
9/16″x 5/8″ to 1″	2 1/2
9/16″x1 1/8″ to 6″	2
5/8″ to 2″x2 1/8″ to 4″	2
5/8″ to 2″x4 1/8″ to 7″	4
2 1/8″ to 3″x2 1/8″ to 4″	2
2 1/8″ to 3″x4 1/8″ to 7″	4

Intermediate sizes take next higher extra.
All dimensions inclusive.
Annealing 2c per lb. extra.

CUTTING CHARGES

24″ and over	1c. per lb.
18″ to 24″	2c. " "
12″ to 18″	3c. per lb.
6″ to 12″	4c. " "
Under 6″	8c. per lb.

FRASSE ALLOY CONSTRUCTION STEEL

(Electric Furnace and Open Hearth)

Frasse Alloy Construction Steel

Unless otherwise specified, our alloy construction steels, as shown on pages 25 to 34, are furnished in hot rolled machine straightened bars, all bars being machinable, i e., when the steel in its natural condition is too hard to machine without annealing, we furnish it annealed.

We can also furnish it as follows:

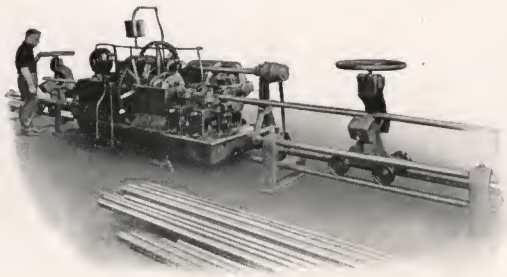
Billets
Annealed or Unannealed Bars
Cold Drawn and Straightened Bars
Turned and Straightened Bars
Turned, Straightened and Polished Bars
Bars Heat-Treated to Specifications and Straightened

Parts manufactured by customers from alloy construction steels will be heat-treated or case-hardened. See pages 41 to 43.

Heat-treating specification blanks will be sent on request.

Temper Numbers

No. 1	Temper	Carbon	Content	(Case Hardening)
" 2	"	"	"	.20% to .30%
" 3	"	"	"	.25% to .35%
" 4	"	"	"	.30% to .40%
" 5	"	"	"	.35% to .45%
" 6	"	"	"	.40% to .50%



Frasse-Electric
Alloy Construction Steel

It has been fully established during the past few years that steels produced by the electric furnace method possess a much higher degree of purity—mainly owing to the absence of sulphurous and oxidizing gases—than the steels manufactured by any other process in use to-day. The electric furnace process makes it possible to obtain an extremely high temperature, resulting in a more complete removal of the undesirable metalloids found in all steels, and a more perfect deoxidation on account of the neutral or reducing atmosphere. The injurious effects of phosphorus and sulphur are thus removed, as it practically eliminates these detrimental elements.

The quality, efficiency and particularly the high degree of uniformity of the Frasse-Electric Alloy Construction Steels have received wide commercial recognition.

Brand ENS—3½ (No. 1 Temper)

Electric 3½% Nickel Steel for Case-Hardening

(Analysis)

Carbon .17% maximum; Nickel 3.25–3.75%.

For all parts which are to be wholly or partly case-hardened and which must be especially tough and uniform, such as

Bolts	Gear Wheels
Boxes	Pins
Cam Shafts	Steering Parts, Etc.

Physical Properties

Average Figures

	Yield Pt.	Ult. Strength	El. in 2″	Red.
Annealed after rolling.....	50,000	70,000	34%	65%
The core, after case-hardening ...	70,000	95,000	27%	55%

Brand ENS—3½ (No. 4 Temper)

Electric 3½% Nickel Steel

(Analysis)

Carbon .30–.40%; Nickel 3.25–3.75%

For

Axles	Gears
Crank Shafts	Shafts
Connecting Rods	Steering Levers
Fittings	Swivels, Etc.

and for parts requiring great strength, toughness and resistance to fatigue, and high ratio of elastic limit to ultimate strength.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2″	Red.
55,000 to 165,000	90,000 to 185,000	30% to 12%	60% to 28%

Brand ECNS—3.00/.60 (No. 1 Temper)

Electric Chrome Nickel Steel for Case-Hardening

(Analysis)

Carbon .17% Maximum; Chromium .50–.75%; Nickel 2.75–3.25%.

For parts to be wholly or partly case-hardened where very high tensile strength combined with great toughness is required, such as

Bolts	Square Shafts
Change Gear Wheels	Steering Parts
Live Axles	Etc.

Physical Properties

Average Figures

	Yield Pt.	Ult. Strength	El. in 2″	Red.
Annealed after rolling	60,000	90,000	30%	60%
The core, after case-hardening	130,000	160,000	13%	45%

Brand ECNS—4.00/1.20 (No. 1 Temper)

Electric Chrome Nickel Steel for Case-Hardening.

(Analysis)

Carbon .17% Maximum; Chromium 1.00–1.35%; Nickel 3.75–4.25%.

For the same purposes as brand ECNS 3.00/.60 (No. 1 Temper) but giving higher physical properties.

Physical Properties

Average Figures

	Yield Pt.	Ult, Strength	El. in 2"	Red.
Annealed after rolling.....	70,000	115,000	23%	55%
The core, after case-hardening....	155,000	185,000	12%	50%

Brand ECNS—3.00/.80 (No. 4 Temper)

Electric Chrome Nickel Steel

(Analysis)

Carbon .30–.40%; Chromium .65–.95%; Nickel 2.75–3.25%.

For very highly stressed parts such as

Axles	Steering Parts
Connecting Rods	Swivels
Shafts	Etc.

and other parts subjected chiefly to bending strains and heavy shocks.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2"	Red
60,000 to 250,000	100,000 to 270,000	25% to 10%	65% to 25%

Brand ECNS—1.25/.60

Electric Low Chrome Nickel Steel

(Analysis)

Carbon .10 to .50% (10 point spread required on each individual order); Nickel 1.00–1.50%; Chromium .40–.70%.

For parts subjected to heavy strains or constant vibration. An excellent steel for threading and machining, having a wide range of uses, some of which are

Axles	Nuts	Shafts
Bolts	Pinions	Spindles
Chuck Jaws	Pins	Studs
Gears	Rods	Valves
Joints	Screws	Vise Jaws, Etc.

Physical Properties

Vary according to carbon content, section and treatment from

Yield Pt.	Ult. Strength	El. in 2"	Red.
45,000 to 180,000	80,000 to 210,000	33% to 10%	65% to 40%

Brand EHCC

Electric High Carbon Chromium Steel

For machined parts which require hardness of a great degree and to a considerable depth, such as

Balls	Discs
Ball Bearings	Hammer Faces
Ball Races	Jewelers Rolls
Bedding Dies	Roller Bearings,
Cold Rolls	Etc.

Weld: not weldable.

Forge: lemon to light yellow—1832/2012° F.—1000/1100° C.

Harden: medium cherry—1364/1418° F.—740/770° C.

Brand ESMS

Electric Silico-Manganese Steel

(Analysis)

Carbon .65–.80%, total range; Manganese .30–.50%; Silicon 1.70–2.05%.

Used essentially for vehicle springs.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2″	Red.
70,000 to 190,000	100,000 to 220,000	20% to 5%	40% to 10%

Brand ECSMS

Electric Chrome Silico-Manganese Steel

(Analysis)

Carbon .35–.60%, total range; Silicon .40–.55%; Manganese .70–.90%; Chromium .70–1.00%.

A particularly high quality of steel for vehicle springs and gears.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2″	Red.
60,000 to 170,000	100,000 to 210,000	20% to 5%	50% to 25%

Special Analysis Steel

We are prepared to furnish electric furnace alloy construction steel of any special acceptable analysis in heat lots of 15 tons upward.

Frasse Open Hearth Alloy Construction Steel

Our various grades of Open Hearth Alloy Construction Steels are manufactured from carefully selected raw materials and are produced under modern and exceptional conditions of equipment. Each grade is carefully and thoroughly worked in a furnace which is under absolute heat control, and the utmost care is exercised in the rolling of the steel to eliminate all surface defects.

The brands listed under this heading will give splendid results when used for the purposes for which they are intended.

Brand ONS—3½ (No. 1 Temper)

3½% Nickel Steel for Case-Hardening

(Analysis)

Carbon .12–.23%; Nickel 3.00–4.00%.

For parts which are to be wholly or partly case-hardened and which must be especially tough and uniform, such as

Bolts	Gear Wheels
Boxes	Pins
Cam Shafts	Steering Parts, Etc.

Physical Properties

Average Figures

	Yield Pt.	Ult. Strength	El. in 2″	Red.
As rolled	40,000	80,000	33%	62%
The core, after case-hardening	85,000	135,000	18%	45%

SCLEROSCOPE 89

Brand ONS—3½ (No. 2 Temper)

3½% Nickel Steel

(Analysis)

Carbon .20–.30%; Nickel 3.00–4.00%.

For

Axles	Gears
Connecting Rods	Shafts
Crank Shafts	Steering Levers
Fittings	Swivels, Etc.

and all parts requiring great strength, toughness and resistance to fatigue, and high ratio of elastic limit to ultimate strength. This temper is widely used without heat treating.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2"	Red.
45,000 to 125,000	85,000 to 140,000	30% to 12%	60% to 30%

Brand ONS—3½ (No. 4 Temper)

3½% Nickel Steel

(Analysis)

Carbon .30–.40%; Nickel 3.00–4.00%.

For

Axles	Gears
Connecting Rods	Shafts
Crank Shafts	Steering Levers
Fittings	Swivels, Etc.

and all parts requiring great strength, toughness and resistance to fatigue, and high ratio of elastic limit to ultimate strength.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2″	Red.
50,000 to 160,000	90,000 to 185,000	28% to 10%	57% to 25%

3½% Nickel Steel

can be furnished in

Carbon .12–.50% (10 point spread required) giving physical properties varying according to section, carbon content and treatment from

Yield Pt.	Ult. Strength	El. in 2″	Red.
40,000 to 180,000	80,000 to 200,000	35% to 8%	65% to 25%

Brand OCNS 3.50/1.50 (No. 4 Temper)

High Chrome Nickel Steel

(Analysis)

Carbon .30–.40%; Chromium 1.25–1.75%; Nickel 3.00–4.00%.

For parts requiring great strength and freedom from brittleness such as, shafts, gears and large constructional parts.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2″	Red.
60,000 to 230,000	100,000 to 250,000	20% to 10%	60% to 40%

Brand OCNS 1.50/.60 (No. 1 Temper)

Low Chrome Nickel Steel for Case-Hardening

(Analysis)

Carbon .12–.23%; Chromium .40–.80%; Nickel 1.00–1.75%.

For parts to be wholly or partly case-hardened, such as

Ball Joints	Screws
Ball Races	Socket Joints
Bearings	Spindles
Bolts	Studs
Cams	Worms
Gears	Etc.

Physical Properties

Average Figures

	Yield Pt.	Ult. Strength	El. in 2″	Red.
As rolled	40,000	80,000	32%	61%
The core, after case-hardening	70,000	110,000	20%	38%

Scleroscope 93

Brand OCNS 1.50/.60 (No. 4 Temper)

Low Chrome Nickel Steel

(Analysis)

Carbon .30–.40%; Chromium .40–.80%; Nickel 1.00–1.75%.

For parts subjected to heavy strains and constant vibration; threads can be cut very smoothly and will stand an enormous amount of strain without stripping. This steel

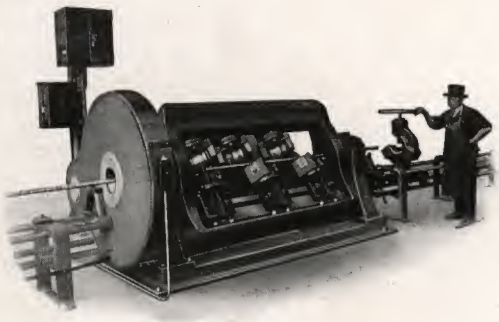
has a wide range of uses, only a few of which can be enumerated, such as

Axles	Nuts	Shafts
Bolts	Pinions	Spindles
Chuck Jaws	Pins	Studs
Drop Forgings	Piston Rods	Valves
Gears	Punches	Vise Jaws
Joints	Screws	Etc.

Physical Properties

Vary according to section and treatment from

Yield Pt.	Ult. Strength	El. in 2"	Red.
60,000 to 175,000	95,000 to 200,000	25% to 11%	55% to 43%



QUALITY PAF SERVICE

Frasse-Tool and Alloy Steels

Classification of Extras

ROUND, SQUARE, OCTAGON, HEXAGON

Inches	Cents per lb.	Inches	Cents per lb.
5/8 to 2	Base	9/16 to 1/2	1/2
2 1/8 to 3	1	7/16 to 3/8	1
3 1/8 to 4	1 1/2	5/16 and 11/32	2
4 1/8 to 5	2	1/4 and 9/32	3
5 1/8 to 6	2 1/2	3/16	5
6 1/8 to 7	3	5/32	10
7 1/8 to 8	3 1/2	1/8	18

FLAT

1/8 x 5/16	20	5/16 x 3/8 to 5/8	1 1/2
1/8 x 1/4	15	5/16 x 11/16 to 8	1
1/8 x 5/16	8	3/8 x 7/16 to 8	1
1/8 x 3/8	4	7/16 x 1/2 to 8	1
1/8 x 7/16 to 1/2	3	1/2 x 9/16 to 8	1
1/8 x 9/16 to 7	2	9/16 x 2 1/8 to 8	1
1/8 x 7 1/8 to 8	3	9/16 to 2 x 5/8 to 2	0
5/16 x 1/4	5	5/8 to 2 x 2 1/8 to 7	1
5/16 x 5/16	4	5/8 to 1 3/4 x 7 1/8 to 8	1
5/16 x 3/8	3	1 7/8 to 2 x 7 1/8 to 8	1 1/2
5/16 x 7/16 to 5/8	2	2 1/8 to 3 x 2 1/8 to 5	1
5/16 x 11/16 to 2	1 1/2	2 1/8 to 3 x 5 1/8 to 8	1 1/2
5/16 x 2 1/8 to 7	1	3 1/8 to 4 x 3 1/8 to 6	1 1/2
5/16 x 7 1/8 to 8	2	3 1/8 to 4 x 6 1/8 to 8	2
1/4 x 5/16 to 3/8	2	4 1/8 to 5 x 4 1/8 to 7	2
1/4 x 7/16 to 5/8	1 1/2	4 1/8 to 5 x 7 1/8 to 8	2 1/2
1/4 x 11/16 to 2	1 1/2	5 1/8 to 6 x 5 1/8 to 8	2 1/2
1/4 x 2 1/8 to 7	1	6 1/8 to 7 x 6 1/8 to 7	3
1/4 x 7 1/8 to 8	2	6 1/8 to 8 x 7 1/8 to 8	3 1/2

Annealing ..... 1 cent per lb.
Annealing—Brand EHCC ..... 2 cents per lb.

Cutting Charges

24 inches and over	1/2c. per lb.
18 " to 24 inches	1c. " "
12 " " 18 "	1 1/2c. " "
6 " " 12 "	2c. " "
Less than 6 inches	Special price
Over 18 feet	Special price

Annealed Discs and Cutter Blanks

Extras

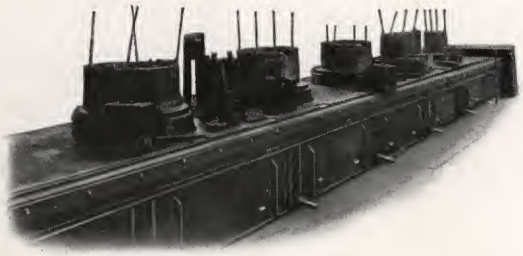
				Base price	per pound
Weighing	above 25	lbs.	Extra	.03c.	" "
"	15 to 25	"	"	.05c.	" "
"	10 to 15	"	"	.06c.	" "
"	7½ to 10	"	"	.07c.	" "
"	5 to 7½	"	"	.08c.	" "
"	3 to 5	"	"	.09c.	" "
"	2 to 3	"	"	.11c.	" "
"	1 to 2	"	"	.12c.	" "
"	under 1	"	"	Flat price	25c. each

Die Blocks

Extras

				Base price	per pound
Weighing	above 25	lbs.	Extra	.02c.	" "
"	15 to 25	"	"	.03c.	" "
"	10 to 15	"	"	.05c.	" "
"	7½ to 10	"	"	.07c.	" "
"	5 to 7½	"	"	.08c.	" "
"	3 to 5	"	"	.09c.	" "
"	2 to 3	"	"	.11c.	" "
"	1 to 2	"	"	.12c.	" "
"	under 1	"	"	Flat price	25c. each

Annealing All Sizes 1c. Extra



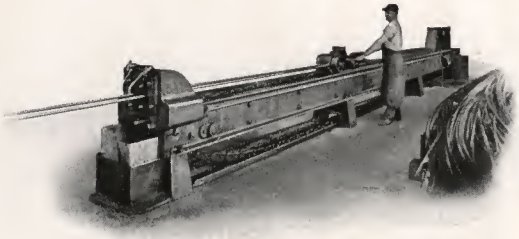
COLD FINISHING
AND
HEAT-TREATING

Cold Finishing

Our cold finishing department is completely equipped to finish bars accurately to size within a few thousandths of an inch. We are prepared to furnish any of our various brands of steel in cold drawn, or turned and polished, and straightened bar form.

Our excellent facilities for doing this class of work, and the special methods employed to obtain close and uniform accuracy to size, enable our customers to order the exact size of the largest dimension of the article or part to be manufactured, as the steel will vary so slightly from the true size.

In addition to furnishing our own brands of steel cold finished, we also extend our exceptional facilities in this respect to the trade for converting bars supplied by them on a tonnage basis.



Cold Finishing

Price List (subject to discount)

Rounds

	Per Pound		Per Pound
1/8" to 5/32"	$0.09 1/2	3 1/16" to 3 7/16"	$0.05 1/2
3/16" to 7/32"	.07 1/2	3 1/2" to 3 15/16"	.05 3/4
1/4" to 3/8"	.06 1/2	4" to 4 1/16"	.06
7/16" to 9/16"	.06	4 1/2" to 4 15/16"	.06 1/2
5/8" to 11/16"	.05 3/4	5" to 5 1/16"	.07
3/4" to 1 7/16"	.05 1/2	5 1/2" to 5 15/16"	.07 3/4
1 1/2" to 1 15/16"	.05 1/4	6" to 6 7/16"	.08 1/2
2" to 3"	.05	6 1/2" to 7"	.09

Flats

Thickness in Inches	1/4"	5/16" to 1/2"	9/16" to 23/32"	3/4" to 1"	1 1/16" to 1 1/2"	1 9/16" to 3"	Wider than 3"
1/8" and 5/32"	20	18	18	14	12	10	10
3/16" to 5/16"	18	16	16	12	10	8	10
3/8" to 7/16"	..	14	14	10	10	8	10
1/2" to 9/16"	..	..	10	8	8	8	10
5/8" to 11/16"	..	..	10	8	8	8	10
3/4" to 15/16"	..	..	..	8	8	8	10
1" to 1 7/16"	..	..	..	..	8	8	10
1 1/2" to 1 11/16"	..	..	..	..	..	8	10
1 3/4" to 1 15/16"	..	..	..	..	..	8	10
2" to 2 15/16"	..	..	..	..	..	8	10

Squares and Hexagons

	Per Pound		Per Pound
1/8" to 5/32"	$0.14	1/2" to 5/8"	$0.08 1/2
3/16" to 7/32"	.12	11/16" to 13/16"	.07 3/4
1/4" to 5/16"	.10	7/8" to 2"	.07
3/8" to 7/16"	.09		

On inquiries mention quality of steel to be cold finished.

Cold drawing and straightening.....Disct.

Turning and straightening.....Disct.

For cold finished tool steel, see drill rod list, pages 63 and 64.

When the steel is furnished by us no charge is made for the waste ends, but the customer assumes all waste on bars or material sent to us for cold finishing.

Extras for Cutting to Lengths

(No Extra for Lengths 5 to 24 feet)

Length	Rounds and Hexagons Per 100 Lbs.	Squares Per 100 Lbs.	Flats Per 100 Lbs.
3″ to 5 15/16″	$1.00	$1.00	$2.00
6″ to 11 15/16″	.50	.50	1.00
12″ to 23 15/16″	.25	.50	.50
24″ to 59 15/16″	.10	.25	.25

For lengths shorter than 3 inches and longer than 24 feet, special prices will be quoted.

Quantity Differentials

All specifications for less than 2,000 pounds of a size will be subject to the following extras, the total weight of a size ordered to determine the extra, regardless of length and regardless of the exact quantity actually shipped.

Less than 2,000 pounds, but not less than 1,000 pounds.....$0.15 per 100 pounds extra

Quantities less than 1,000 pounds. .35 per 100 pounds extra

Standard Sizes and Tolerances

Sizes by thirty-seconds up to 1 inch, inclusive, and by sixteenths larger than 1 inch, are considered standard.

Cold drawn alloy steel will be furnished within .002 inch under and .002 inch over, or a total tolerance of .004 inch. For closer accuracy, but for a total tolerance of not less than .0015 inch, an extra of ½ cent per pound will be added. For closer accuracy, special prices will be quoted.

Heat-Treating

We have unexcelled facilities for scientific and special heat-treating, enabling us to furnish our various grades of steel heat-treated to the physical properties specified—or heat-treated but soft enough to machine after heat-treating.

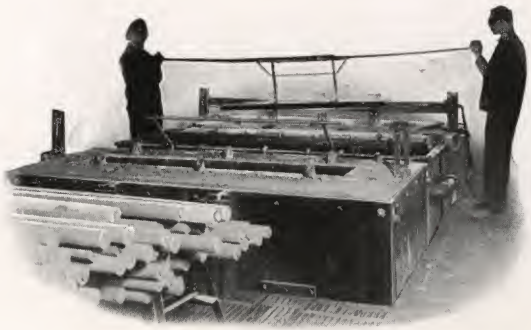
We are prepared to execute orders promptly for heat-treating, annealing and case-hardening bars or parts for customers against their specifications.

We have special facilities for annealing, and can handle bars up to 20 ft. in length.

The quality of our work is assured by the employment of the most approved methods, and the fact that all work is conducted under the supervision of experienced steel experts.

The most satisfactory results are obtained when we are given information in detail of the customer's requirements and we strongly urge this procedure in every instance.

Heat-treatment blanks will be sent on request.



Selection of Steel for Heat Treatment

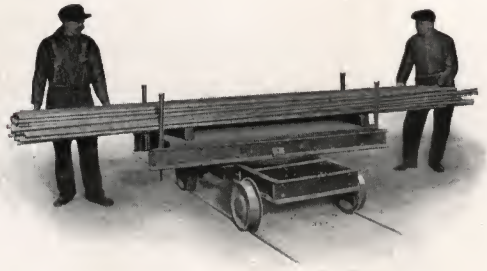
When placing an order for steel to be heat-treated the following points should be observed:

Parts to be case-hardened should be made of steels with a low carbon content, and parts that are to be heat-treated to high physical properties should be made of steels of higher carbon content.

The most satisfactory steels for case-hardening purposes and for heat-treating to high physical properties are those made by the electric furnace, crucible or open hearth processes, as these methods of manufacture insure against the injurious effects of excess phosphorus and sulphur. It is a loss of time and labor to attempt to toughen or refine successfully the core of case-hardened steel high in impurities. It is also useless to attempt to heat-treat to high physical properties steel that is high in impurities.

Alloy steels as employed in preference to straight carbon steels, add to the parts to be manufactured a wider range of physical properties resultant from heat treatment.

Our engineering department will be glad to aid and advise in the proper selection of steel to meet customer's requirements.



Guarantee of Physical Properties

The extent of our guarantee of resultant physical properties is limited to the restrictions placed upon us by the customer. It is quite obvious that where the purchaser specifies the chemical content, and demands that certain physical properties be obtained from its heat-treatment, we cannot absolutely guarantee to secure the desired physical characteristics, unless, in our judgment, they can be obtained by heat-treatment from the steel of the analysis specified.

Our full guarantee to furnish steel to required physical properties, is given where the customer allows us to select the steel and to prescribe its heat-treatment, and also in such instances where the customer furnishes the steel, which, in our opinion, is of suitable analysis to obtain the desired physical characteristics, and for which we are permitted to prescribe the heat-treatment.

Under no circumstances can we accept specifications that include the chemical analysis of the steel, and the physical properties required, and where the heat-treatment is prescribed by the customer.

We guarantee the hardness and physical properties of steel or parts sent to us to be case-hardened, where we have been permitted to select the steel, but in the event that the customer sends us parts to be case-hardened, made of steel purchased elsewhere, we can only extend our guarantee to meet physical specifications when complete information is furnished us regarding the analysis of the steel, and which in our judgment is considered suitable to give the physical properties desired.

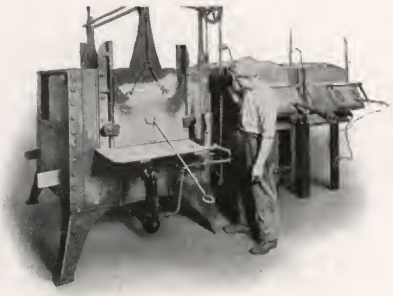
Hardening and Tempering Colors With Centigrade and Fahrenheit Temperature Equivalents

Hardening and tempering by color only, is a method that is not to be recommended on account of the uncertain results which are frequently obtained, and therefore should never be employed where the equipment includes pyrometers or other reliable temperature recording instruments.

For the benefit of our customers who still rely on the color method only for hardening and tempering, the chart on page 45 was prepared.

As there is a wide variation in the opinions of many authorities regarding a definite temperature equivalent for each hardening or tempering color, this table was compiled by taking the average of ten prominent authorities.

Detailed Hardening and Tempering instructions of our various brands of steel will be furnished on request.



Hardening and Tempering Colors

WITH CENTIGRADE AND FAHRENHEIT TEMPERATURE EQUIVALENTS.

Color	Deg. Cent.	Deg. Fahr.	Color	Deg. Cent.	Deg. Fahr.	Color	Deg. Cent.	Deg. Fahr.
Light	210	410		610	1130		1010	1850
Straw	220	428	Blood	620	1148		1020	1868
	230	446	Red	630	1166		1030	1886
Dark	240	464		640	1184		1040	1904
Light	250	482		650	1202	Light	1050	1922
Brown	260	500		660	1220	Yellow	1060	1940
Dark	270	518		670	1238		1070	1958
Light	280	536	Dark	680	1256		1080	1976
Purple	290	554	Cherry	690	1274		1090	1994
Dark	300	572		700	1292		1100	2012
Dark	310	590		710	1310		1110	2030
	320	608		720	1328		1120	2048
Blue	330	626		730	1346		1130	2066
	340	644		740	1364	Cream	1140	2084
Light	350	662	Me-	750	1382		1150	2102
	360	680	dium	760	1400		1160	2120
	370	698	Cherry	770	1418		1170	2138
Oxide	380	716		780	1436		1180	2156
Gray	390	734		790	1454		1190	2174
	400	752	Light	800	1472		1200	2192
	410	770	Cherry	810	1490		1210	2210
	420	788		820	1508		1220	2228
Dark	430	806		830	1526		1230	2246
Red	440	824	Dark	840	1544	White	1240	2264
(In the	450	842	Orange	850	1562		1250	2282
Dark)	460	860		860	1580		1260	2300
	470	878		870	1598		1270	2318
Dark	480	896	Me-	880	1616		1280	2336
Red	490	914	dium	890	1634		1290	2354
(In	500	932	Orange	900	1652		1300	2372
Twi-	510	950		910	1670		1310	2390
light)	520	968	Light	920	1688		1320	2408
	530	986	Orange	930	1706	Scintil-	1330	2426
Dark	540	1004		940	1724	lating	1340	2444
Red	550	1022		950	1742	White	1350	2462
(In	560	1040		960	1760		1360	2480
Day-	570	1058	Lemon	970	1778		1370	2498
light)	580	1076		980	1796		1380	2516
Blood	590	1094		990	1814		1390	2534
Red	600	1112		1000	1832		1400	2552

Machining Allowances

Through repeated heatings the surface of steel is always reduced sufficiently in carbon to prevent it from properly hardening.

This decarbonized surface, or skin, should always be removed by machining, and when ordering steel, allowances in size must be made in order to have sufficient stock to produce a tool of even percentage of carbon, from center to extreme surface points.

The depth of this decarbonization varies in proportion to the sectional area of the bars, which is found to be about 4½% of the diameter or square of round and square bars, respectively.

On flats the decarbonization will be found to run heavier on the edges than on the sides, because of the reduction of the bar in rolling being made on the sides rather than on the edges, in which case the 4½% decarbonized surface holds good. For example, taking a 4″ x 1″ bar: on the 4″ sides it would be necessary to machine off only .045″ from each side and on the edges it would be necessary to remove .180″ from each edge. When removing the given allowances, it is very important that the same amount of steel is taken from each side, as in the case of a round bar, which must be accurately centered in the lathe, otherwise, in hardening, one side of the tool or part will be hard, while the other side is soft.

The following table has been prepared for the convenience of our customers.

TABLE OF MACHINING ALLOWANCES

1	to	3	square	inches	area	remove	1/16″	on	each	side
3	"	7	"	"	"	"	3/32″	"	"	"
7	"	12	"	"	"	"	1/8″	"	"	"
12	"	19	"	"	"	"	5/32″	"	"	"
19	"	28	"	"	"	"	3/16″	"	"	"
28	"	38	"	"	"	"	7/32″	"	"	"
38	"	50	"	"	"	"	1/4″	"	"	"

FRASSE
SCREW STEEL AND SHAFTING

HARTFORD TURNED AND POLISHED
SHAFTING

Frasse Cold Drawn Screw Steel

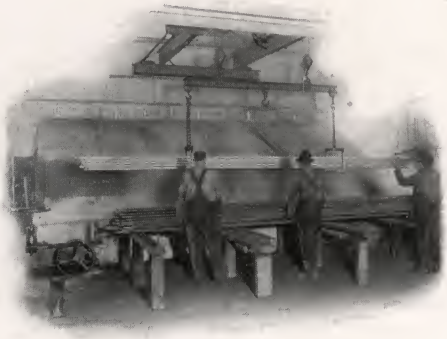
Our screw steel is free cutting, homogeneous, and straight, and permits accurate and rapid machining with a minimum amount of wear on tools. This steel is suitable for cutting, threading, forming, parting and general screw machine operations. The customer may select the exact size of the largest dimension of the article to be produced, as the material has only a slight variation from true size.

Small and special sizes will be made where the quantity is sufficient to warrant the expenditure necessary for making the dies.

Frasse Cold Drawn Shafting

Sizes up to 2″ rounds

We manufacture this shafting by the most modern methods. The material is the best obtainable quality of soft steel for shafting. It is straight, accurate to size and has a very good surface finish.



Hartford Turned and Polished Shafting

To the trade and to manufacturers in general who desire or require the highest quality of shafting, and at prices comparing favorably to or only slightly higher than the ordinary grades of cold drawn shafting, we direct special attention to the superior quality of Hartford Turned and Polished Shafting.

This shafting is manufactured of the best quality open hearth steel, and is machine turned, highly polished and straightened with great care, being given a final press straightening to ensure its being as straight and uniform as it is possible to make.

We especially recommend the desirability of specifying Hartford Turned Shafting for all high grade requirements, as the turning process removes the outer skin of the material and eliminates all rolling stresses or internal strains and surface defects that are usually present in shafting finished by the cold drawing process.

Hartford Turned Shafting is accurate to size, has a superior surface finish and possesses great strength and uniformity, due to the absence of internal strains and surface defects.

We solicit inquiries or specifications from manufacturers whose requirements indicate the advisability of using the best grade of shafting obtainable.

We recommend that this class of shafting be shipped boxed.

Cold Drawn Screw Steel

STANDARD PRICE LIST

Adopted March 15, 1915

ROUNDS

Size	Weight per Foot Pounds	Price per Pound	Size	Weight per Foot Pounds	Price per Pound
1/16	0.0104	$0.10	2 3/8	15.04	
3/32	.0234		2 7/16	15.84	
1/8	.041	.095	2 1/2	16.66	
5/32	.0725		2 9/16	17.50	
3/16	.093	.075	2 5/8	18.37	$0.05
1/4	.166		2 11/16	19.26	
5/16	.260	.065	2 3/4	20.16	
3/8	.375		2 13/16	21.09	
7/16	.510		2 7/8	22.04	
1/2	.666	.06	2 15/16	23.00	
9/16	.843		3	24.00	
5/8	1.04	.0575	3 1/16	25.00	
11/16	1.26		3 1/8	26.04	
3/4	1.50		3 3/16	27.09	
13/16	1.757		3 1/4	28.16	.055
7/8	2.04		3 5/16	29.26	
15/16	2.34		3 3/8	30.37	
1	2.66		3 7/16	31.51	
1 1/16	3.01	.055	3 1/2	32.66	
1 1/8	3.36		3 9/16	33.84	
1 3/16	3.76		3 5/8	35.04	
1 1/4	4.16		3 11/16	36.26	.0575
1 5/16	4.59		3 3/4	37.50	
1 3/8	5.04		3 7/8	40.04	
1 7/16	5.50		3 15/16	41.34	
1 1/2	6.00		4	42.66	
1 9/16	6.51		4 3/16	46.76	.06
1 5/8	7.04		4 1/4	48.16	
1 11/16	7.59	.0525	4 7/16	52.51	
1 3/4	8.16		4 1/2	54.00	
1 13/16	8.76		4 3/4	60.16	.065
1 7/8	9.37		4 15/16	65.01	
1 15/16	10.02		5	66.66	
2	10.66		5 1/4	73.50	.07
2 1/16	11.34		5 7/16	78.84	
2 1/8	12.04	.05	5 1/2	80.66	
2 3/16	12.76		5 3/4	88.16	.0775
2 1/4	13.50		5 15/16	94 01	
2 5/16	14.26		6	96.00	.085

Subject to discount.

QUALITY PAF SERVICE

Cold Drawn Screw Steel

STANDARD PRICE LIST

Adopted March 15, 1915

SQUARES

Size	Weight per Foot Pounds	Price per Pound	Size	Weight per Foot Pounds	Price per Pound
1/8	.053	$0.14	1 9/16	8.32	
5/32	.086		1 5/8	8.98	
3/16	.119	.12	1 11/16	9.68	
1/4	.212	.10	1 3/4	10.42	$0.07
5/16	.332		1 13/16	11.18	
			1 7/8	11.96	
3/8	.478	.09	1 15/16	12.77	
7/16	.652		2	13.60	
1/2	.850	.085	2 1/16	14.39	
9/16	1.08		2 1/8	15.26	
5/8	1.33		2 3/16	16.18	.08
			2 1/4	17.25	
11/16	1.67	.0775	2 5/16	18.09	
3/4	1.91		2 3/8	19.07	
13/16	2.25		2 7/16	20.09	
7/8	2.60		2 1/2	21.26	
15/16	2.99		2 5/8	23.59	
1	3.40		2 3/4	25.72	.085
1 1/16	3.85		2 15/16	29.18	
1 1/8	4.30		3	30.61	
1 3/16	4.79	.07			
1 1/4	5.31		3 1/16	31.94	
1 5/16	5.85		3 1/4	35.92	.09
1 3/8	6.43		3 1/2	41.67	
1 7/16	7.03		4	54.40	
1 1/2	7.65				

Subject to discount.

QUALITY PAF SERVICE

Cold Drawn Screw Steel

STANDARD PRICE LIST

Adopted March 15, 1915

HEXAGONS

Size	Weight per Foot Pounds	Price per Pound	Size	Weight per Foot Pounds	Price per Pound
3/8	0.04875	$0.14	1 11/16	8.37	
3/16	.1075	.12	1 3/4	9.00	
1/4	.195	.10	1 13/16	9.65	$0.07
5/16	.29		1 7/8	10.32	
			1 15/16	11.00	
3/8	.43	.09	2	11.70	
7/16	.56				
			2 1/16	12.51	
1/2	.73	.085	2 1/8	13.27	
9/16	.93		2 3/16	14.08	
5/8	1.15		2 1/4	14.85	.08
			2 5/16	15.80	
11/16	1.40	.0775	2 3/8	16.58	
3/4	1.66			17.50	
13/16	1.91		2 7/16		
			2 1/2	18.37	
7/8	2.25		2 9/16	19.35	
15/16	2.58		2 5/8	20.25	
1	2.94		2 11/16	21.25	
1 1/16	3.33		2 3/4	22.25	.085
1 1/8	3.73		2 13/16	23.28	
1 3/16	4.15		2 7/8	24.31	
1 1/4	4.60	.07	2 15/16	25.38	
1 5/16	5.07		3	26.45	
1 3/8	5.57				
1 7/16	6.07		3 1/16	27.475	.09
1 1/2	6.62		3 1/8	28.50	
1 9/16	7.17		4	.....	
1 5/8	7.76				

Subject to discount.

QUALITY PAF SERVICE

Cold Drawn Screw Steel

STANDARD PRICE LIST

FLATS

Inches Thickness	1/4	5/16 to 1/2	9/16 to 23/32	3/4 to 1	1 1/16 to 1 1/2	1 9/16 to 1 3/4	1 13/16 to 2	2 1/16 to 2 1/4	2 5/16 to 2 1/2	2 9/16 to 2 3/4	2 13/16 to 3	3 1/16 to 3 1/4	3 5/16 to 3 1/2	3 9/16 to 4	4 1/16 to 4 1/2	4 9/16 to 5 1/2	5 1/16 to 6
3/32	20	18	18	14	12	10	10	..	..	..	..	..	..	..	..	..	..
1/8 and 5/32	20	18	18	14	12	10	10	10	10	10	10	10	..	..	..	..	..
3/16 to 5/16	18	16	16	12	10	8	8	8	8	8	8	10	10	..	..	..	..
3/8 to 7/16	..	14	14	10	10	8	8	8	8	8	8	10	10	10	10	10	10
1/2	..	..	10	8	8	8	8	8	8	8	8	10	10	10	10	10	10
9/16 to 11/16	..	..	10	8	8	8	8	8	8	8	8	10	10	10	10	10	..
3/4 to 15/16	..	..	..	8	8	8	8	8	8	8	8	10	10	10	10	10	..
1 to 1 7/16	..	..	..	..	8	8	8	8	8	8	8	10	10	10	10	10	..
1 1/2 to 1 9/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	10	10	..
1 11/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	..	..	..
1 3/4 to 1 15/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	..	..	..
2 to 2 3/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	..	..	..
2 1/4 to 2 7/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	..	..	..
2 1/2 to 2 11/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	..	..	..
2 3/4 to 2 15/16	..	..	..	..	..	8	8	8	8	8	8	10	10	10	..	..	..
3 5/16 to 3 15/16	..	..	..	..	..	..	..	..	..	..	..	..	10	10	..	..	..

Subject to discount.

Standard Classification of Extras

Adopted March 15, 1915

Shafting—Extras on Rounds, Sizes Smaller than 3/4 Inch:

List prices on sizes smaller than 3/4 inch apply on screw stock quality in random mill lengths only. All other qualities or screw stock cut to accurate lengths—15 cents per 100 pounds net extra, in addition to usual extras for accuracy, short and long lengths.

Extra for Odd and Intermediate Sizes:

The following sizes in rounds, hexagons, squares and flats shall be considered standard:

By 64ths to 1 inch, inclusive.
By 32ds—1 1/32 inches to 1 31/32 inches, inclusive.
By 16ths—2 inches to maker's limit.

All odd and intermediate sizes, excepting those allowing a total tolerance of .008 inch (and such specifications shall be for not less than 2,000 pounds of a size), not less than 25 cents per 100 pounds net extra, in addition to the usual extras for accuracy, etc.

Extras for Accuracy:

For accuracy from exact size to .0015 inch under, sizes 3 inches diameter and smaller. . 25 cents per 100 pounds net.

For accuracy from exact size to .001 inch under, or from exact size to not more than .001 inch either way, sizes 2 1/2 inches diameter and smaller. . . . . 50 cents per 100 pounds net.

For accuracy within .0005 inch either way of a specified size or from exact size to .001 inch over, sizes 2 inches diameter and smaller. . . . . $1.00 per 100 pounds net.

Standard Classification of Extras

Adopted March 15, 1915

Extras for Chamfering (For Screw Machine Use Only):

	Rounds Per 100 Pounds Net	Hexagons and Squares Per 100 Pounds Net
7/16 inch to 5/8 inch	$0.13	$0.15
11/16 inch to 15/16 inch	.10	.13
1 inch to 2 inches	.065	.115
2 1/16 inches and larger	.04	.10

These extras apply on lengths 10 feet and longer and one end bar only. For sizes smaller than 7/16 inch and shorter than 10 feet, special prices will be quoted.

Extras for Special and High Carbon Open Hearth Steels:

Specified Analysis—Carbon .30% and less.....25c per 100 lbs. net.

Specified Analysis—Phos. and Sul. .05% Max.....25c per 100 lbs. net.

Specified Analysis—Carbon .30% and less, sulphur guaranteed (under .05%)50c per 100 lbs. net.

Specified Analysis—Carbon .31% to 50%50c per 100 lbs. net.

Quantity Differentials:

All specifications for less than 1000 pounds of a size will be subject to the following extras, the total weight of a size ordered to determine the extra, regardless of length and regardless of the exact quantity actually shipped:

500 to 999 pounds.....$0.05 per 100 pounds net.
100 to 499 pounds..... .10 per 100 pounds net.
Less than 100 pounds..... .20 per 100 pounds net.

Standard Classification of Extras

Adopted March 15, 1915

Extras for Long and Short Lengths (Per 100 Pounds Net):

	Rounds	Squares	Hexagons	Flats
3 inches to 5 15/16 inches...	$1.00	$1.00	$1.00	$2.00
6 inches to 11 15/16 inches...	.50	.50	.50	1.00
12 inches to 23 15/16 inches...	.25	.50	.25	.50
24 inches to 59 15/16 inches...	.10	.25	.10	.25

Lengths longer than 24 feet and less than 30 feet	$0.50 per 100 pounds net.
30 feet and less than 35 feet	1.00 per 100 pounds net.
35 feet and less than 40 feet	1.50 per 100 pounds net.
40 feet and less than 45 feet	2.00 per 100 pounds net.
45 feet and longer	2.50 per 100 pounds net.

Extras for long lengths apply on Rounds, Squares, Hexagons and Flats.

Boxing and Burlaping:

Boxing (minimum 50 cents)	$0.20 per 100 pounds
Burlaping (minimum 25 cents), full length	.15 per 100 pounds
Burlaping of ends only	.05 per 100 pounds

Piston Rod Steel:

Uniformity to size and carefully selected surface finish—50 cents per 100 pounds net extra, in addition to usual extras for accuracy and short and long lengths.

TABLE OF NET PRICES OF COLD DRAWN STEEL, FIGURED FROM LIST DISCOUNT AND PREMIUM

List Price Per Pound		5	5¼	5½	5¾	6	6½	7	7½	7¾	8	8½	9	9½	10	12	14	16	18	20
Discount	60%	2.00	2.10	2.20	2.30	2.40	2.60	2.80	3.00	3.10	3.20	3.40	3.60	3.80	4.00	4.80	5.60	6.40	7.20	8.00
	55	2.25	2.36	2.48	2.59	2.70	2.93	3.15	3.38	3.49	3.60	3.83	4.05	4.28	4.50	5.40	6.30	7.20	8.10	9.00
	50	2.50	2.63	2.75	2.88	3.00	3.25	3.50	3.75	3.88	4.00	4.25	4.50	4.75	5.00	6.00	7.00	8.00	9.00	10.00
	45	2.75	2.89	3.03	3.16	3.30	3.58	3.85	4.13	4.26	4.40	4.68	4.95	5.23	5.50	6.60	7.70	8.80	9.90	11.00
	40	3.00	3.15	3.30	3.45	3.60	3.90	4.20	4.50	4.65	4.80	5.10	5.40	5.70	6.00	7.20	8.40	9.60	10.80	12.00
	35	3.25	3.41	3.58	3.74	3.90	4.23	4.55	4.88	5.04	5.20	5.53	5.85	6.18	6.50	7.80	9.10	10.40	11.70	13.00
	30	3.50	3.68	3.85	4.03	4.20	4.55	4.90	5.25	5.43	5.60	5.95	6.30	6.65	7.00	8.40	9.80	11.20	12.60	14.00
	25	3.75	3.94	4.13	4.32	4.50	4.88	5.25	5.63	5.82	6.00	6.38	6.75	7.13	7.50	9.00	10.50	12.00	13.50	15.00
	20	4.00	4.20	4.40	4.60	4.80	5.20	5.60	6.00	6.20	6.40	6.80	7.20	7.60	8.00	9.60	11.20	12.80	14.40	16.00
	15	4.25	4.46	4.68	4.89	5.10	5.53	5.95	6.38	6.59	6.80	7.23	7.65	8.08	8.50	10.20	11.90	13.60	15.30	17.00
	10	4.50	4.73	4.95	5.18	5.40	5.85	6.30	6.75	6.98	7.20	7.65	8.10	8.55	9.00	10.80	12.60	14.40	16.20	18.00
	5	4.75	4.99	5.23	5.46	5.70	6.18	6.65	7.13	7.36	7.60	8.08	8.55	9.03	9.50	11.40	13.30	15.20	17.10	19.00
Premium	5	5.25	5.51	5.78	6.04	6.30	6.83	7.35	7.88	8.14	8.40	8.93	9.45	9.98	10.50	12.60	14.70	16.80	18.90	21.00
	10	5.50	5.78	6.05	6.33	6.60	7.15	7.70	8.25	8.53	8.80	9.35	9.90	10.45	11.00	13.20	15.40	17.60	19.80	22.00
	15	5.75	6.04	6.33	6.61	6.90	7.48	8.05	8.63	8.91	9.20	9.78	10.35	10.93	11.50	13.80	16.10	18.40	20.70	23.00
	20	6.00	6.30	6.60	6.90	7.20	7.80	8.40	9.00	9.30	9.60	10.20	10.80	11.40	12.00	14.40	16.80	19.20	21.60	24.00
	25	6.25	6.56	6.88	7.19	7.50	8.13	8.75	9.38	9.69	10.00	10.63	11.25	11.88	12.50	15.00	17.50	20.00	22.50	25.00
	30	6.50	6.83	7.15	7.48	7.80	8.45	9.10	9.75	10.08	10.40	11.05	11.70	12.35	13.00	15.60	18.20	20.80	23.40	26.00
	35	6.75	7.09	7.43	7.76	8.10	8.78	9.45	10.13	10.46	10.80	11.48	12.15	12.83	13.50	16.20	18.90	21.60	24.30	27.00

The Standard Extras for Quantity are to be Added to these Prices

Coppered Bessemer Rods

These rods are made of the very best grade of Bessemer steel, are accurate to size, and are copper coated to receive nickel plating.

It is advisable when ordering, to specify desired size in thousandths or fractional parts of an inch.

Sizes carried in stock in 6 foot lengths.

Diameter in Inches	Decimal of an Inch	Approx. Weight per Foot (Lbs.)	Extras for Size (Cents)
1/64	.047	.006	.05 1/2
	.054	.007	.03 1/2
1/16	.063	.010	
	.072	.014	
5/64	.078	.015	.02
	.084	.019	
3/32	.094	.024	
	.101	.027	
7/64	.109	.032	.01
	.118	.037	
1/8	.125	.042	
	.132	.047	1/2
9/64	.141	.053	
	.145	.056	
	.151	.061	
5/32	.156	.064	
	.164	.072	
11/64	.172	.079	
	.178	.085	
	.184	.090	
3/16	.187	.093	
	.191	.096	
	.197	.103	
13/64	.203	.109	Base
	.209	.117	
	.212	.120	
7/32	.219	.127	
	.223	.133	
	.230	.141	
15/64	.234	.146	
	.245	.160	
1/4	.250	.167	
	.260	.180	
17/64	.266	.189	
	.272	.198	
	.276	.206	
9/32	.281	.211	
	.289	.223	
19/64	.297	.236	
	.302	.243	
5/16	.312	.260	
	.316	.272	
	.323	.278	
21/64	.328	.287	
11/32	.344	.316	
	.348	.321	
23/64	.359	.343	
	.368	.362	
3/8	.375	.375	
	.381	.387	Base
	.386	.397	
25/64	.391	.407	
	.397	.421	
	.404	.432	
13/32	.406	.434	
	.413	.455	
27/64	.422	.471	
	.433	.501	
7/16	.438	.510	
	.446	.531	
29/64	.453	.544	
15/32	.469	.585	
31/64	.484	.627	
1/2	.500	.667	
33/64	.516	.710	
17/32	.531	.756	
35/64	.547	.800	
9/16	.562	.845	.03
5/8	.625	1.041	
11/16	.688	1.265	
3/4	.750	1.500	

Cold Rolled Strip Steel

Cold rolled strip steel is used extensively with entire satisfaction in the manufacture of Sewing Machine, Cash Register, Adding and Calculating Machine, Bicycle, Motorcycle and Automobile parts, Hardware, Stove Trimmings, Skates, and all classes of stampings or work requiring the highest finished product, uniform in quality and accurate to gauge.

When ordering, or requesting quotation, kindly state fully as to width, gauge and temper desired, whether in coils or cut to length; round or sheared edges.

If possible, specify thickness in thousandths of an inch, to avoid confusion or delay. When gauge number is given, we will understand it to be Birmingham or Stubs gauge. If very exact gauge is required, do not fail to mention when ordering.

List of Tempers

A—HARD. For flat work.

B—HALF HARD. Bends fairly well across the grain.

C—QUARTER HARD. Bends to the right angles across grain and fairly well with grain.

D—SOFT. For ordinary bending and easy drawing.

E—DEAD SOFT. For deep drawing.

Cold Rolled Strip Steel

In Straight Lengths (72″ Long)

CLASSIFICATION OF EXTRAS FOR SHIPMENT FROM STOCK
ADD THESE EXTRAS, WITH THE EXTRAS FOR QUANTITY, TO THE BASE PRICE

	Over 9″ to 12″ wide		Over 6″ to 9″ wide		6″ to 1½″		Under 1½″ to 1″		Under 1″ to ⅜″		Under ⅜″ to 3/16″	
	Hard	Soft	Hard	Soft	Hard	Soft	Hard	Soft	Hard	Soft	Hard	Soft
.100 and thicker	.10	.35	.10	.35	.10	.35	.25	.50	.55	.80	1.40	1.65
.050—.099	.20	.45	.20	.45	.20	.45	.35	.60	.85	1.10	1.45	1.70
.036—.049	.35	.60	.35	.60	.35	.60	.50	.75	1.00	1.25	1.60	1.85
.035	.75	1.00	.35	.60	.35	.60	.50	.75	1.00	1.25	1.60	1.85
.031—.034	1.00	1.40	.75	1.15	.60	1.00	.75	1.15	1.40	1.80	2.25	2.65
.026—.030	1.25	1.65	1.00	1.40	.85	1.25	1.00	1.40	1.75	2.15	2.35	2.75
.025	1.45	1.85	1.10	1.50	.85	1.25	1.00	1.40	1.75	2.15	2.35	2.75
.020—.024	1.65	2.05	1.30	1.70	1.05	1.45	1.20	1.60	2.10	2.50	2.95	3.35
.017—.019	3.20	3.20	2.95	2.95	2.45	2.45	2.60	2.60	3.65	3.65	4.75	4.75
.015—.016	....	....	3.35	3.35	2.85	2.85	3.00	3.00	4.05	4.05	5.15	5.15
.013—.014	....	....	....	....	3.95	3.95	4.10	4.10	4.75	4.75	5.85	5.85

EXTRAS FOR QUANTITY

2000 lbs. and over	$ .25 per cwt.	300 lbs. to 499 lbs. of a size	$2.00 per cwt.
1000 lbs. to 1999 lbs. of a size	.40 " "	200 " " 299 " " " "	3.00 " "
500 " " 999 " " " "	1.00 " "	Less than 200 lbs.	5.00 " "

EXTRAS FOR SHEARING

⅛″ (.125) and thinner .02½c per cut
Minimum charge 1 sheet .25 cents

Accuracy in shearing depends on the gauge and hardness of the steel, and the width and length of the strips to be cut. We are equipped to do careful, accurate work, but do not guarantee exact size.

Cold Rolled Strip Steel

Classification of Extras for Shipment from Mill—Base Sizes 1½" and Wider x .100" and Thicker in Coils

Thickness in Decimals of Inch	Extra for Thickness Hard Temper in Coils	Extra for All Tempers Except Hard	Extra for Straightening and Cutting 24" Lengths or Longer 1½" or Wider	Special Widths—Extras, Add to Corresponding Size 1½" and Wider					
				Narrower than 1½" to 1" Inc. Coils or Lengths	Narrower than 1" to ½" Inc. Coils	Narrower than 1" to ½" Inc. Cut Lengths 24" or Longer	Wider than 6" to 9" Inc.	Wider than 9" to 12" Inc.	Wider than 12" to 15" Inc.
.100 & thicker	Base	.25	A .10	.15	.30	B .45	....	....	C ....
.050—.099 .	.05	.25	.15	.15	.30	.65	....	....	....
.036—.049 .	.20	.25	.15	.15	.30	.65	....	....	.25
.035	.20	.25	.15	.15	.30	.65	....	.40	.50
.031—.034 .	.35	.40	.25	.15	.30	.80	.15	.40	.60
.026—.030 .	.45	.40	.40	.15	.30	.90	.15	.40	.75
.025	.45	.40	.40	.15	.30	.90	.25	.60	X
.020—.024 .	.55	.40	.50	.15	.30	1.05	.25	.60	....
.017—.019 .	1.35	No	1.10	.15	.30	1.20	.50	X	....
.015—.016 .	1.75	Extra	1.10	.15	.30	1.20	.50	....	X Extras
.013—.014 .	2.45	for	1.50	.15	.30	.80	X	....	Quoted
.012	2.80	Temper	2.00	.15	.30	Coils	....	....	on
.011	3.15		2.00	.15	.30	only	....	....	Application
.010	3.50		2.00	.15	.30		....	....	

A. For cutting to lengths under 24" triple extras. B. Under 24" quoted on application. C. Wider than 15" quoted on application.
For Boxing or Wrapping—15c per 100 lbs. Extra will be charged—Minimum charge 50c.

EXTRAS FOR SMALL QUANTITIES

On orders or contracts for 18 Tons or more add extras only on items of less than 2000 lbs.

3 to less than 18 tons of one size	$ .10 per cwt.	500 to 999 lbs. of one size	$1.00 per cwt.
1 " " " 3 " " " "	.25 " "	300 " 499 " " " "	2.00 " "
1000 " 1999 lbs. of one size	.40 " "	200 " 299 " " " "	3.00 " "

100 to 199 lbs. of one size $5.00 per cwt.

Orders for less than 100 lbs. of one size will be accepted only at the full value of 100 lbs.

NOTE.—The charge for cutting to length does not relieve buyer from scrap loss, and short pieces left from cutting will be shipped and invoiced at price of long lengths. If lengths over 36" are ordered and no short pieces taken, add 10% to net price.

Polished Drill Rods

Recommended for small taps, reamers, punches, twist drills, dental tools, watch parts, and for all similar tools requiring great accuracy.

Superior Brand

This is our very best grade, which is made of the finest quality of high carbon tool steel. It is accurately drawn and has a splendid surface finish. Standard lengths three feet.

Star Brand

This brand is lower in price than the foregoing brand, but is of excellent quality, and accurately drawn. Standard lengths three feet.

Stubs Brand

Made of bright round carbon steel. Standard lengths three feet.

Flying Scotsman High Speed Brand

Furnished in round straight lengths—one meter long,—also furnished lime drawn in coils and straight lengths.

Polished Drill Rods

PRICE LIST (Subject to Discount)

Size	Equivalent Decimals	Superior and Star	Stubs Brand	F. S. High Speed	Size	Equivalent Decimals	Superior and Star	Stubs Brand	F. S. High Speed
		$	$	$			$	$	$
1 ½ in.	1.500	Per	Per	Per	21–64	.3281	Per	Per	Per
1 ¼	1.250	Lb.	Lb.	Lb.	P	.323	Lb.	Lb.	Lb.
1	1.000				O	.316			
31–32	.969				5–16	.3125			
15–16	.937	0.50			N	.302			
29–32	.906				19–64	.2968			
7–8	.875				M	.2950			
27–32	.844				L	.290			
13–16	.812				9–32	.2812			
25–32	.781			1.65	K	.281			
3–4	.750				J	.277			
23–32	.719				I	.272			
11–16	.687				H	.266			
21–32	.656	.55			17–64	.2656			1.75
5–8	.625				G	.261			
19–32	.594				F	.257			
9–16	.562				E	.250			
17–32	.531				1–4	.250			
1–2	.500				D	.246			
31–64	.4843				C	.242	.75	.95	
15–32	.4687	.60	.95		B	.238			
29–64	.4531				15–64	.2343			
7–16	.4375				A	.234			
27–64	.4218				1	.227			
Z	.413				2	.219			
13–32	.4062				7–32	.2187			
Y	.404				3	.212			
X	.397				4	.207			
25–64	.3906			1.75	5	.204			
W	.386				13–64	.2031			
V	.377	.75			6	.201			
3–8	.375				7	.199			
U	.368				8	.197			
23–64	.3593				9	.194			1.85
T	.358				10	.191			
S	.348				11	.188			
11–32	.3437				3–16	.1875			
R	.339				12	.185			
Q	.332				13	.182			

Polished Drill Rods—*Continued*

PRICE LIST (Subject to Discount)

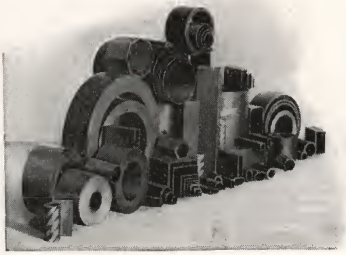
Size	Equivalent Decimals	Superior and Star	Stubs Brand	F. S. High Speed	Size	Equivalent Decimals	Superior and Star	Stubs Brand	F. S. High Speed
		$	$	$			$	$	$
14	.180	0.75	0.95	1.85	5–64	.0781			
15	.178				47	.077			
16	.175				48	.075	1.20	1.50	2.95
17	.172				49	.072			
11–64	.1718				50	.069			
18	.168				51	.066			
19	.164				52	.063			
20	.161				1–16	.0625	1.45	1.85	3.55
21	.157				53	.058			
5–32	.1562				54	.055			
22	.155	.83	1.05	2.00	55	.050			
23	.153				3–64	.0468	1.80	2.25	4.40
24	.151				56	.045			
25	.148				57	.042			
26	.146				58	.041			
27	.143				59	.040	2.10	2.65	5.35
9–64	.1406				60	.039			
28	.139				61	.038	2.40	3.00	
29	.134				62	.037			
30	.127				63	.036			
1–8	.125				64	.035	2.70	3.40	
31	.120				65	.033			
32	.115				66	.032			
33	.112				1–32	.0312	3.00	3.75	
34	.110				67	.031			
7–64	.1093	.90	1.15	2.20	68	.030			
35	.108				69	.029	3.30	4.05	
36	.106				70	.027			
37	.103				71	.026			
38	.101				72	.024	3.60		
39	.099				73	.023			
40	.097				74	.022	3.90		
41	.095				75	.020	4.05		
3–32	.0937				76	.018	4.20		
42	.092	1.05	1.35	2.55	77	.016	4.50		
43	.088				1–64	.0156			
44	.085				78	.015	4.80		
45	.081				79	.014	5.10		
46	.079				80	.013	5.40		

For Intermediate Sizes take next Highest List.

SHELBY
SEAMLESS STEEL TUBE

QUALITY PAF SERVICE

Shelby Cold Drawn Seamless Steel Tube



We are distributors for the states of New York, New Jersey, Connecticut, Eastern Pennsylvania, Delaware, Maryland and Virginia of the well known Shelby Steel Tubing—long conceded to be the standard seamless steel tubing of the world. Shelby Seamless Steel Tubes are extensively used for various mechanical and engineering purposes. They are adapted to a large variety of applications and are now used in almost all classes of manufacturing industries.

The material from which these tubes are made is the best that can be obtained—it machines readily and cuts free and clean. Both cold drawn and hot rolled tubes are furnished for mechanical purposes. Owing to its smooth finish and slight variation in diameter and gauge, a cold drawn steel tube can often be used to advantage and with economy in place of an article ordinarily machined from solid stock, and possesses the maximum of strength with the minimum of weight.

Tube Trade Customs

Unless otherwise ordered, random mill lengths, 5′ to 18′ inclusive will be shipped. For cut, multiple or specified lengths, from 1′ to 18′ inclusive, from our warehouse stock, a cutting charge of 10 per cent. will be made. Lengths under 1′ long, an additional charge per 100 cuts will be made.

Unless otherwise specified all seamless steel tubes will be shipped "finish anneal," which is a medium temper, and can be cut or threaded, and is suitable for all purposes where strength and toughness are required.

Every piece of tube is carefully tested, but it is impossible to always detect imperfections, the only guarantee that is given is to replace such goods as prove defective, and then only in case material is in lengths originally shipped. Under no circumstances is the seller responsible for any damages beyond the price of the goods.

No charges for labor or expense required to repair defective goods, or occasioned by them, will be allowed.

On all orders for tubing of special sizes, gauges and shapes, the privilege is reserved by us of sending 10 per cent more or less than the actual quantity specified.

Claims for shortage, or deduction for erroneous charges, must be promptly presented, or will not be allowed. Claims must state order number and date of invoice and shipment.

Quotations are made for immediate acceptance, and are subject to change without notice.

Boxing. All freight shipments, 16 ga. and lighter, will be shipped boxed without imposing any boxing charge. Tubes

heavier than 16 ga. will be shipped bundled, unless ordered boxed, in which case an extra charge will be made.

Delivery. F.O.B. Mill or our Warehouses, at our option.

General Information

With a view to expediting and handling orders to best advantage we respectfully call attention to the information given below. We strongly urge upon our customers the importance of giving complete information of their particular requirements regarding variations, anneal, straightness, lengths, etc.

The outside diameters of cold drawn tubes are fairly true to size and seldom vary more than from .005 to .015 of an inch from the true diameter, depending upon the size of the tube. Such variations are usually larger than the true diameter, the greater appearing only in the larger sizes. This is due to the wear of cold-drawing dies, and when ordering tubing where outside diameter is required closer than these variations, the above facts should be considered.

The inside diameters of cold drawn seamless tubes have approximately the same variation as the outside diameters; but the inside diameter is liable to be slightly smaller than the true diameter. With heavy walls the variation would be greater, and the inside diameter would probably be slightly larger or smaller than the true diameter.

The variations in gauge or thickness of wall is liable to occur to greater or less degree in all seamless tubes, and is primarily due to the irregular flow of heated metal of billet when being forced over the piercing mandrel point during piercing operation. The variation of flow of metal varies in different portions of the same billet, resulting in a slightly dif-

ferent thickness of wall in the same billet, or different thicknesses of wall in different billets, both treated exactly in the same manner. Every possible means are employed to reduce this variation to a minimum, as none of the subsequent operations of manufacture can entirely eliminate these variations. The thickness of the wall is reduced in rolling and cold drawing, and the variation is reduced approximately; when the tube is finished it will have relatively the same percentage of variation as it had in the form of a pierced billet, which is comparatively very much shorter and heavier in wall than the finished tube. The amount of this variation is hard to determine, as it follows no fixed law and often does not occur at all; but many seamless tubes vary 5 per cent, from the true thickness or gauge, occasionally they vary 10 per cent, but seldom beyond that. This large variation can be detected by the eye, and such tubes are set aside and not finished or cold drawn. This variation of wall must be considered when ordering tubes for mechanical purposes where uniformity of wall is essential, and the necessary allowance must be made for machining where the requirements demand it. In such cases, it is necessary that customer give the finished size of outside and inside diameter, and the mill will furnish tubes that will machine to the required sizes.

The anneal or temper of seamless tubes is important and should be carefully considered by customer when ordering. All seamless tubes after being cold drawn are very hard and inclined to be brittle, and must be annealed to suit different requirements. They are furnished in three tempers: hard, medium and soft.

The hard temper is used where great rigidity and stiffness are required, and where tubes are not to be bent or manipulated to change their form.

The medium temper is used where strength and toughness are required, and where only slight change of form is required.

The soft temper is used where the tubes must be manipulated and where a decided change of form is required that demands ductile and pliable material.

The straightness of seamless tubes depends somewhat on their size, thickness and temper, but it is impossible to insure an absolutely straight tube.

Tubes of Special Steel

High Carbon

We can also furnish mechanical tubes made from .30 to .40 carbon steel, which possess special characteristics, such as higher tensile strength and elastic limit.

Customers who use .30 to .40 carbon tubing expect same to take temper when heated to red heat and plunged in water or oil. While we do not guarantee that this material will temper under these conditions, many of our customers have worked it this way and found it very satisfactory.

3½% Nickel

We can furnish 3½ per cent Nickel Steel Tubes with .25 Carbon which will give very much higher tensile strength and elastic limit than ordinary carbon stock.

Both of the above special products can be used to advantage in automobile construction where the material is required to meet special conditions.

Special Chrome

These tubes are used extensively for roller and ball bearings. We can furnish them in any size required.

We shall be pleased to submit special prices on receipt of inquiries covering specifications of size, gauge, length, etc.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

Round. Price List.—Per Foot.

Thickness B.W.G and Fractions	Equivalent in Decimal of Inch	OUTSIDE DIAMETER IN INCHES.																												
		¼	5/16	⅜	7/16	½	9/16	⅝	11/16	¾	13/16	⅞	15/16	1	1 1/16	1 ⅛	1 3/16	1 ¼	1 5/16	1 ⅜	1 7/16	1 ½	1 5/8	1 ¾	1 7/8	2
24	.022	35.09	35.09	35.09	35.09	35.09	27.11	27.11	22.14	22 .14	19 .16	19 .16	17 .18	17 .18	15 .21	15 .21	14 .23	14 .23	13 .25	13 .25	12 .28	12 .28	.....	.....	.....	.....
22	.028	35.09	35.09	35.09	35.09	35.09	27.11	27.11	22.14	22 .14	19 .16	19 .16	17 .18	17 .18	15 .21	15 .21	14 .23	14 .23	13 .25	13 .25	12 .28	12 .28	7 .58	.....	.....	.....
20	.035	35.09	35.09	35.09	35.09	35.09	27.11	27.11	22.14	22 .14	19 .16	19 .16	17 .18	17 .18	15 .21	15 .21	14 .23	14 .23	13 .25	13 .25	12 .28	12 .28	7 .58	7 .58	7 .67	7 .67
18	.049	26.12	26.12	26.12	26.12	26.12	22.15	22.15	19.19	19 .19	16 .22	16 .22	14 .25	14 .25	12 .28	12 .28	10 .32	10 .32	9 .35	9 .35	9 .38	9 .38	7 .58	7 .58	7 .67	7 .67
17	.058	22.15	22.15	22.15	22.15	22.15	19.20	19.20	16.24	16 .24	14 .28	14 .28	12 .33	12 .33	10 .37	10 .37	9 .41	9 .41	8 .46	8 .46	7 .50	7 .50	7 .58	7 .58	7 .67	7 .67
16	.065	22.15	22.15	22.15	22.15	22.15	19.20	19.20	16.24	16 .24	14 .28	14 .28	12 .33	12 .33	10 .37	10 .37	9 .41	9 .41	8 .46	8 .46	7 .50	7 .50	7 .58	7 .58	7 .67	7 .67
14	.083	.....	19.19	19.19	19.19	19.19	16.24	16.24	14.30	14 .30	12 .35	12 .35	10 .42	10 .42	9 .46	9 .46	8 .52	8 .52	7 .57	7 .57	6 .63	6 .63	5 .74	5 .74	4 .85	4 .85
13	.095	.....	16.22	16.22	16.22	16.22	14.27	14.27	12.33	12 .33	10 .40	10 .40	9 .46	9 .46	8 .52	8 .52	7 .59	7 .59	6 .65	6 .65	5 .71	5 .71	4 .84	4 .84	3 .97	3 .97
12	.109	.....	.....	15.23	15.23	15.23	12.30	12.30	10.38	10 .38	9 .45	9 .45	8 .52	8 .52	7 .59	7 .59	6 .67	6 .67	5 .74	5 .74	4 .81	4 .81	3 .96	3 .96	1.10	1.10
11	.120	.....	.....	13.25	13.25	13.25	11.33	11.33	9.41	9 .41	8 .49	8 .49	7 .57	7 .57	6 .65	6 .65	5 .73	5 .73	4 .81	4 .81	3 .89	3 .89	2 1.05	2 1.05	1.21	1.21
10	.134	.....	.....	.....	.....	10.35	10.35	10.35	8.44	8 .44	7 .53	7 .53	6 .62	6 .62	5 .71	5 .71	4 .80	4 .80	3 .89	3 .89	2 .98	2 .98	1 1.16	1 1.16	1.34	1.34
5/32	.156	.....	.....	.....	.....	7.50	7.50	7.50	7.50	7 .50	6 .60	6 .60	5 .71	5 .71	4 .81	4 .81	3 .91	3 .91	2 1.02	2 1.02	1 1.12	1 1.12	1.33	1.33	1.54	1.54
3/16	.188	.....	.....	.....	.....	6.57	6.57	6.57	6.57	6 .57	5 .69	5 .69	4 .82	4 .82	3 .94	3 .94	2 1.07	2 1.07	1 1.19	1 1.19	1.32	1.32	1.57	1.57	1.82	1.82
7/32	.219	.....	.....	.....	.....	.....	.....	.....	.....	4 .77	4 .77	4 .77	3 .91	3 .91	2 1.06	2 1.06	1 1.21	1 1.21	1.35	1.35	1.50	1.50	1.79	1.79	2.08	2.08
¼	.250	.....	.....	.....	.....	.....	.....	.....	.....	2 1.00	2 1.00	2 1.00	2 1.00	2 1.00	1 1.17	1 1.17	1.34	1.34	1.50	1.50	1.67	1.67	2.00	2.00	2.34	2.34
5/16	.313	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.57	1.57	1.57	1.57	1.57	1.77	1.77	1.98	1.98	2.40	2.40	2.82	2.82
⅜	.375	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.75	1.75	1.75	2.00	2.00	2.25	2.25	2.75	2.75	3.25	3.25
½	.500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.67	3.34	3.34	4.00	4.00
⅝	.625	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.59

Differential Discount for small sizes in left hand corner—deduct from Base Discount to obtain net discount.
Where no Differential Discount is shown, Base Discount only applies.
Heavy type show our standard stock sizes, which will be supplied in any quantity.
We have in stock many sizes not standard, some as listed in light types, others in intermediate sizes and gauges.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES.

Round. Price List—Per Foot.

Thickness B.W.G. & Fractions	Equiv. in Dec. of Inch	OUTSIDE DIAMETER IN INCHES																	
		2⅛	2¼	2⅜	2½	2⅝	2¾	2⅞	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½
16	.065	[7].76	[7].76	[7].85	[7].85	[7].93	[7].93	1.48	1.48	1.60	1.73	2.33	2.49	.....	.....	.....	.....	.....	.....
14	.083	[8].96	[8].96	[11].07	[11].07	1.18	1.18	1.48	1.48	1.60	1.73	2.33	2.49	.....	.....	.....	.....	.....	.....
13	.095	[11].10	[11].10	1.22	1.22	1.35	1.35	1.48	1.48	1.60	1.73	2.33	2.49	.....	.....	.....	.....	.....	.....
12	.109	1.25	1.25	1.39	1 39	1.54	1.54	1.69	1.69	1.83	1.97	2.33	2.49	.....	.....	.....	.....	.....	.....
11	.120	1.37	1.37	1.53	1.53	1.69	1.69	1.85	1.85	2.01	2.17	2.33	2.49	2.95	3.13	3.31	3.48	3.65	3.84
10	.134	1.52	1.52	1.70	1.70	1.87	1.87	2.05	2.05	2.23	2.41	2.59	2.77	2.95	3.13	3.31	3.48	3.65	3.84
5/32	.156	1.75	1.75	1.96	1.96	2.16	2.16	2.37	2.37	2.58	2.79	3.00	3.21	3.41	3.62	3.83	4.04	4.25	4.46
3/16	.188	2.07	2.07	2.32	2.32	2.57	2.57	2.82	2.82	3.07	3.32	3.57	3.82	4.07	4.32	4.57	4.82	5.07	5.32
7/32	.219	2.37	2.37	2.66	2.66	2.96	2.96	3.25	3.25	3.54	3.83	4.12	4.41	4.71	5.00	5.29	5.58	5.87	6.16
¼	.250	2.67	2.67	3.00	3.00	3.34	3.34	3.67	3.67	4.00	4.34	4.67	5.00	5.34	5.67	6.00	6.34	6.68	7.00
5/16	.313	3.23	3.23	3.65	3.65	4.07	4.07	4.48	4.48	4.90	5.32	5.73	6.15	6.57	6.98	7.40	7.82	8.23	8.65
⅜	.375	3.75	3.75	4.25	4.25	4.76	4.76	5.25	5.25	5.75	6.25	6.75	7.25	7.75	8.25	8.76	9.26	9.76	10.26
½	.500	4.67	4.67	5.34	5.34	6.00	6.00	6.67	6.67	7.34	8.00	8.67	9.34	10.00	10.67	11.34	12.00	12.67	13.34
⅝	.625	5.42	5.42	6.25	6.25	7.09	7.09	7.92	7.92	8.75	9.59	10.42	11.25	12.09	12.92	13.76	14.59	15.42	16.26
¾	.750	.....	.....	.....	.....	.....	.....	.....	9.00	10.00	11.00	12.01	13.00	14.01	15.01	16.01	17.01	18.00	19.01
⅞	.875	.....	.....	.....	.....	.....	.....	.....	9.92	11.09	12.26	13.42	14.59	15.76	16.92	18.09	19.26	20.42	21.59
1	1.000	.....	.....	.....	.....	.....	.....	.....	10.67	12.01	13.34	14.67	16.01	17.34	18.67	20.01	21.34	22 67	24.01

Differential Discount for small sizes in left corner—deduct from Base Discount to obtain net discount.

Where no Differential Discount is shown, Base Discount only applies. Heavy type show our standard stock sizes, which will be supplied in any quantity.

We have in stock many sizes not standard, some as listed in light types, others in intermediate sizes and gauges.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

Square Sizes. Price List, Per Foot

Thickness B.W.G. and Fractions	Equivalent in Decimal of Inch	OUTSIDE DIAMETER IN INCHES																		
		½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
20	.035	35.11	27.14	22.17	19.20	17.23	15.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.049	26.15	22.19	19.24	16.28	14.32	12.36	10.53	9 .58	9 .64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	.065	22.19	19.25	16.30	14.36	12.42	10.47	9.53	8 .58	7 .64	7 .75	7 .86	71.39	.....	.....	.....	.....	.....	.....	.....
14	.083	.....	.....	14.38	12.45	10.52	9.59	8.66	7 .73	6 .80	5 .94	41.08	31.39	.....	.....	.....	.....	.....	.....	.....
13	.095	.....	.....	.....	10.51	9.59	8.67	7.75	6 .83	5 .91	41.07	21.23	31.39	1.55	1.72	1.88	2.04	.....	.....	.....
12	.109	.....	.....	.....	.....	8.66	7.75	6.85	5 .94	41.03	31.22	11.40	1.59	1.77	1.96	2.14	2.33	.....	.....	.....
11	.120	.....	.....	.....	.....	7.72	6.82	5.92	41.03	31.13	21.33	1.53	1.74	1.94	2.15	2.35	2.55	.....	.....	.....
10	.134	.....	.....	.....	.....	.....	.....	.....	.....	21.47	11.47	1.70	1.93	2.16	2.38	2.61	2.84	3.07	3.29	3.52
5/32"	.156	.....	.....	.....	.....	.....	.....	.....	.....	11.69	1.69	1.96	2.22	2.49	2.76	3.02	3.29	3.55	3.82	4.08
3/16"	.188	.....	.....	.....	.....	.....	.....	.....	.....	1.99	1.99	2.31	2.63	2.95	3.27	3.58	3.90	4.22	4.54	4.86

We can furnish Rectangular, Hexagon and Oval Steel Tube. Prices quoted on receipt of Specifications.
Heavy type show our standard stock sizes, which will be supplied in any quantity.
We have in stock many sizes, not standard, some as listed in light type, others in intermediate sizes and gauges.

ROUND UNDER ¼" OUTSIDE DIAMETER
PRICE LIST—PER FOOT

Thickness B.W.G. and Fractions	Equivalent in Decimals of Inch	OUTSIDE DIAMETER IN INCHES					
		1/16	3/32	1/8	5/32	3/16	7/32
24	.022	.40	.40	.38	.38	.34	.34
21	.032	.....	.40	.38	.38	.34	.34
18	.049	.....	.....	.38	.38	.34	.34
16	.065	.....	.....	.....	.....	.34	.34

We can furnish other sizes and gauges than shown on this list, but tubes will have to be made special. Prices quoted on application.

Differential Discount for small sizes in left corner—deduct from base discount to obtain net discount. Where no Differential Discount is shown Base Discount only applies.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

Pipe Sizes. Price List—Per Foot

STANDARD PIPE						EXTRA STRONG PIPE						DOUBLE EXTRA STRONG PIPE					
Nominal Size Inside Diameter		Thickness of Wall	Nearest Fractional Size of Seamless		Price Per Foot	Nominal Size Inside Diameter		Thickness of Wall	Nearest Fractional Size of Seamless		Price Per Foot	Nominal Size Inside Diameter		Thickness of Wall	Nearest Fractional Size of Seamless		Price Per Foot
Size	O. D.		O. D.	Thickness		Size	O. D.		O. D.	Thickness		Size	O. D.		O. D.	Thickness	
1/8	.405	.068	13/32	16 Ga.	22 .15	1/8	.405	.100	13/32	13 Ga.	16 .22	1/2	.840	.298	27/32	19/64 Wall	1.57
1/4	.540	.088	17/32	14 "	16 .24	1/4	.540	.123	17/32	11 "	11 .33	3/4	1.050	.314	1 1/16	5/16 "	1.57
3/8	.675	.091	21/32	13 "	12 .33	3/8	.675	.127	21/32	10 "	8 .44	1	1.315	.364	1 5/16	23/64 "	2.00
1/2	.840	.109	27/32	12 "	9 .45	1/2	.840	.149	27/32	9 "	6 .60	1 1/4	1.660	.388	1 5/8	25/64 "	3.34
3/4	1.050	.113	1 1/16	12 "	7 .59	3/4	1.050	.157	1 1/16	8 "	3 .94	1 1/2	1.900	.406	1 7/8	13/32 "	4.00
1	1.315	.134	1 5/16	10 "	3 .89	1	1.315	.182	1 5/16	7 "	11 1.19	2	2.375	.442	2 3/8	7/16 "	5.34
1 1/4	1.660	.140	1 5/8	9 "	1.33	1 1/4	1.660	.194	1 5/8	3/16 Wall	1.57	2 1/2	2.875	.560	2 7/8	9/16 "	7.92
1 1/2	1.900	.145	1 7/8	9 "	1.54	1 1/2	1.900	.203	1 7/8	6 Ga.	2.08	3	3.500	.608	3 1/2	19/32 "	9.59
2	2.375	.154	2 3/8	5/32 Wall	1.96	2	2.375	.221	2 3/8	5 "	3.00	3 1/2	4.000	.642	4	5/8 "	11.25
2 1/2	2.875	.204	2 7/8	6 Ga.	3.25	2 1/2	2.875	.280	2 7/8	9/32 Wall	4.48	4	4.500	.682	4 1/2	11/16 "	15.01
3	3.500	.217	3 1/2	7/32 Wall	3.83	3	3.500	.304	3 1/2	5/16 "	5.32						

Differential Discount for small sizes in left corner—deduct from Base Discount to obtain net discount.

Where no Differential Discount is shown Base Discount only applies.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

Round Sizes

Wall Thickness		OUTSIDE DIMENSIONS																			
		1/4″	5/16″	3/8″	7/16″	1/2″	9/16″	5/8″	11/16″	3/4″	13/16″	7/8″	15/16″	1″	1 1/16″	1 1/8″	1 3/16″	1 1/4″	1 5/16″	1 3/8″	1 7/16″	1 1/2″
B. W. Gauge	Decimal Equivalent	INSIDE DIMENSIONS																				
		Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch
24	.022″	.206	.268	.331	.393	.456	.518	.581	.643	.706	.768	.831	.893	.956	1.018	1.081	1.143	1.206	1.268	1.331	1.393	1.456
22	.028″	.194	.256	.319	.381	.444	.506	.569	.631	.694	.756	.819	.881	.944	1.006	1.069	1.131	1.194	1.256	1.319	1.381	1.444
20	.035″	.180	.242	.305	.367	.430	.492	.555	.617	.680	.742	.805	.867	.930	.992	1.055	1.117	1.180	1.242	1.305	1.367	1.430
18	.049″	.152	.214	.277	.339	.402	.464	.527	.589	.652	.714	.777	.839	.902	.964	1.027	1.089	1.152	1.214	1.277	1.339	1.402
17	.058″	.134	.196	.259	.321	.384	.446	.509	.571	.634	.696	.759	.821	.884	.946	1.009	1.071	1.134	1.196	1.259	1.321	1.384
16	.065″	.120	.182	.245	.307	.370	.432	.485	.557	.620	.682	.745	.807	.870	.932	.995	1.057	1.120	1.182	1.245	1.307	1.370
14	.083″	....	.146	.209	.271	.334	.396	.449	.521	.584	.646	.709	.771	.834	.896	.959	1.021	1.084	1.146	1.209	1.271	1.334
13	.095″	....	.122	.185	.247	.310	.372	.425	.497	.560	.622	.685	.747	.810	.872	.935	.997	1.060	1.122	1.185	1.247	1.310
12	.109″	....	....	.157	.219	.282	.344	.397	.469	.532	.594	.657	.719	.782	.844	.907	.969	1.032	1.094	1.157	1.219	1.282
11	.120″	....	....	.135	.197	.260	.322	.375	.447	.510	.572	.635	.697	.760	.822	.885	.947	1.010	1.072	1.135	1.197	1.260
10	.134″	....	....	....	....	.232	.294	.347	.419	.482	.544	.607	.669	.732	.794	.857	.919	.982	1.044	1.107	1.169	1.232
5/32″	.156″	....	....	....	....	.187	.250	.312	.375	.437	.500	.562	.625	.687	.750	.812	.875	.937	1.000	1.062	1.125	1.187
3/16″	.188″	....	....	....	....	.125	.187	.250	.312	.375	.437	.500	.562	.625	.687	.750	.812	.875	.937	1.000	1.062	1.125
7/32″	.219″	....	....	....	....	....	....	....	....	.312	.375	.437	.500	.562	.625	.687	.750	.812	.875	.937	1.000	1.062
1/4″	.250″	....	....	....	....	....	....	....	....	.250	.312	.375	.437	.500	.562	.625	.687	.750	.812	.875	.937	1.000
5/16″	.313″	....	....	....	....	....	....	....	....	....	....	....	....	.375	.437	.500	.562	.625	.687	.750	.812	.875
3/8″	.375″	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.375	.437	.500	.562	.625	.687	.750
1/2″	.500″	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.500

Bold face type show standard stock sizes. Light face type show special sizes that are made on order only.

Courtesy of Otis Elevator Co.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

ROUND SIZES.

Wall Thickness		Outside Dimensions.																				
		1⅝″	1¾″	1⅞″	2″	2⅛″	2¼″	2⅜″	2½″	2⅝″	¾″	2⅞″	3″	3¼″	3½″	3¾″	4″	4¼″	4½″	4¾″	5″	5½″
		Inside Dimensions.																				
B. W. Gauge	Decimal Equival.	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch
22	**.028″**	**1.569**	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	**.035″**	**1.555**	**1.680**	**1.805**	**1.930**	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	**.049″**	**1.527**	**1.652**	**1.777**	**1.902**	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	**.058″**	1.509	1.634	1.759	1.884	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	**.065″**	**1.495**	**1.620**	**1.745**	**1.870**	**1.995**	**2.120**	**2.245**	**2.370**	**2.495**	**2.620**	**2.745**	**2.870**	**3.120**	**3.370**	3.620	3.870	.....	.....	.....	.....	.....
14	**.083″**	**1.459**	**1.584**	**1.709**	**1.834**	1.959	**2.084**	2.209	**2.334**	2.459	**2.584**	2.709	**2.834**	3.084	3.334	3.584	3.834	.....	.....	.....	.....	.....
13	**.095″**	**1.435**	**1.560**	**1.685**	**1.810**	1.935	**2.060**	**2.185**	**2.310**	**2.435**	**2.560**	**2.685**	**2.810**	**3.060**	3.310	3.560	3.810	.....	.....	.....	.....	.....
12	**.109″**	**1.407**	**1.532**	1.657	**1.782**	1.907	2.032	2.157	2.282	2.407	2.532	2.657	2.782	3.032	3.282	3.532	3.782	.....	.....	.....	.....	.....
11	**.120″**	**1.385**	**1.510**	**1.635**	**1.760**	**1.885**	**2.010**	**2.135**	**2.260**	**2.385**	**2.510**	**2.635**	**2.760**	**3.010**	**3.260**	**3.510**	**3.760**	**4.010**	**4 260**	**4.510**	**4.760**	5.260
10	**.134″**	**1.357**	**1.482**	**1.607**	**1.732**	**1.857**	1.982	2.107	**2.232**	2.357	2.482	2.607	2.732	2.982	3.232	3.482	3.732	3.982	4.232	4.482	4.732	5.232
5/32″	.156′	**1.312**	**1.437**	**1.562**	**1.687**	**1.812**	**1.937**	**2.062**	**2.187**	**2.312**	**2.437**	2.562	**2.687**	**2.937**	**3.187**	3.437	**3.687**	3.937	4.187	4.437	**4.687**	5.187
3/16″	.188″	**1.250**	**1.375**	**1.500**	**1.625**	**1.750**	**1.875**	**2.000**	2.125	**2.250**	**2.375**	**2.500**	**2.625**	**2.875**	**3.125**	**3.375**	**3.625**	**3.875**	**4.125**	4.375	**4.625**	**5.125**
7/32″	.219″	1.187	**1.312**	1.437	**1.562**	1.687	**1.812**	**1.937**	**2.062**	2.187	**2.312**	2.437	**2.562**	2.812	**3.062**	3.312	3.562	3.812	4.062	4.312	4.562	5.062
¼″	.250″	**1.125**	**1.250**	**1.375**	**1.500**	**1.625**	**1.750**	**1.875**	**2.000**	**2.125**	**2.250**	**2.375**	**2.500**	**2.750**	**3.000**	**3.250**	**3.500**	**3.750**	**4.000**	**4 250**	**4.500**	**5.000**
5/16″	.313″	**1.000**	**1.125**	**1.250**	**1.375**	**1.500**	**1.625**	**1.750**	**1.875**	**2.000**	**2.125**	**2.250**	**2.375**	**2.625**	**2.875**	**3.125**	**3.375**	**3.625**	**3.875**	4.125	4.375	4.875
3/8″	.375″	**.875**	**1.000**	**1.125**	**1.250**	**1.375**	**1.500**	**1.625**	**1.750**	**1.875**	**2.000**	2.125	**2.250**	**2.500**	**2.750**	**3.000**	**3.250**	**3.500**	**3.750**	**4.000**	4.250	4.750
½″	.500″	**.625**	**.750**	**.875**	**1.000**	**1.125**	**1.250**	**1.375**	**1.500**	**1.625**	**1.750**	**1.875**	**2.000**	**2 250**	**2.500**	**2.750**	**3.000**	**3.250**	**3.500**	**3.750**	**4.000**	4.500
5/8″	.625″	.....	.....	.....	**.750**	.875	**1.000**	1.125	**1.250**	1.375	**1.500**	1.625	**1.750**	**2.000**	**2.250**	**2.500**	**2.750**	**3.000**	**3.250**	3.500	3.750	4.250
¾″	.750″	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	**1.500**	**1.750**	**2.000**	**2.250**	**2.500**	**2.750**	**3.000**	**3.250**	3.500	4.000
⅞″	.875″	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.250	1.500	1.750	2.000	2.250	2.500	2.750	3.000	3.250	3.750
1″	1.000″	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.000	1 250	1.500	1.750	2.000	2.250	2 500	2.750	3.000	3.500

Bold face type show standard stock sizes.
Light face type show special sizes that are made on order only.

Courtesy of Otis Elevator Co.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

Square Sizes

Wall Thickness		OUTSIDE DIMENSIONS																		
		½″	⅝″	¾″	⅞″	1″	1⅛″	1¼″	1⅜″	1½″	1¾″	2″	2¼″	2½″	2¾″	3″	3¼″	3½″	3¾″	4″
		INSIDE DIMENSIONS																		
B.W. Gauge	Decimal Equival.	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch	Inch
20	.035″	**.430**	**.555**	**.680**	**.805**	**.930**	**1.055**	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.049″	**.402**	**.527**	**.652**	**.777**	**.902**	**1.027**	**1.152**	1.277	**1.402**	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	.065″	**.370**	**.495**	**.620**	**.745**	**.870**	**.995**	**1.120**	**1.245**	**1.370**	**1.620**	**1.870**	**2.120**	.....	.....	.....	.....	.....	.....	.....
14	.083″	.....	.....	**.584**	**.709**	**.834**	.959	**1.084**	1.209	**1.334**	**1.584**	1.834	2.084	.....	.....	.....	.....	.....	.....	.....
13	.095″	.....	.....	.....	.685	.810	.935	1.060	1.185	1.310	1.560	1.810	2.060	2.310	2.560	2.810	3.060	.....	.....	.....
12	.109″	.....	.....	.....	.....	.782	.907	1.032	1.157	1.282	1.532	1.782	2.032	2.282	2.532	2.782	3.032	.....	.....	.....
11	.120″	.....	.....	.....	.....	**.760**	.885	**1.010**	1.135	**1.260**	**1.510**	**1.760**	**2.010**	**2.260**	2.510	2.760	3.010	.....	.....	.....
10	.134″	.....	.....	.....	.....	.....	.....	.....	.....	1.232	1.482	1.732	1.982	2.232	2.482	2.732	2.982	3.232	3.482	3.732
5/32″	.156″	.....	.....	.....	.....	.....	.....	.....	.....	1.187	1.437	1.687	1.937	2.187	2.437	2.687	2.937	3.187	3.437	3.687
3/16″	.188″	.....	.....	.....	.....	.....	.....	.....	.....	1.125	1.375	**1.625**	**1.875**	**2.125**	2.375	2.625	2.875	3.125	3.375	3.625

Bold face type show standard stock sizes. Light face type show special sizes that are made on order only.

Courtesy of Otis Elevator Co.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES

Pipe Sizes

STANDARD PIPE							EXTRA STRONG PIPE							DOUBLE EXTRA STRONG PIPE						
Pipe Sizes			Nearest size tubing				Pipe Sizes			Nearest size tubing				Pipe Sizes			Nearest size tubing			
			Wall Thickness							Wall Thickness							Wall Thickness			
Nominal pipe size	Actual pipe size O.D. Inch	Actual pipe size I.D. Inch	B.W. Gauge	Decimal Equival.	O.D. Inch	I.D. Inch	Nominal pipe size	Actual pipe size O.D. Inch	Actual pipe size I.D. Inch	B.W. Gauge	Decimal Equival.	O.D. Inch	I.D. Inch	Nominal pipe size	Actual pipe size O.D. Inch	Actual pipe size I.D. Inch	Fraction	Decimal Equival.	O.D. Inch	I.D. Inch
⅛″	.405	.269	16	.065″	**.406**	**.276**	⅛″	.405	.205	13	.095″	**.406**	**.216**	½″	.840	.244	19/64″	.297″	.844	.250
¼″	.540	.364	14	.083″	**.531**	**.365**	¼″	.540	.294	11	.120″	**.531**	**.291**	¾″	1.050	.422	5/16″	.313″	1.062	.437
⅜″	.675	.493	13	.095″	**.656**	**.466**	⅜″	.675	.421	10	.134″	**.656**	**.388**	1″	1.315	.587	23/64″	.359″	1.313	.594
½″	.840	.622	12	.109″	**.844**	**.626**	½″	.840	.542	9	.148″	**.844**	**.548**	1¼″	1.660	.884	25/64″	.390″	1.625	.844
¾″	1.050	.824	12	.109″	**1.062**	**.844**	¾″	1.050	.736	8	.165″	**1.062**	**.732**	1½″	1.900	1.088	13/32″	.406″	1.875	1.062
1″	1.313	1.047	10	.134″	**1.313**	**1.044**	1″	1.313	.951	7	.180″	**1.313**	**.952**	2″	2.375	1.491	7/16″	.438″	2.375	1.500
1¼″	1.660	1.380	9	.148″	**1.625**	**1.329**	1¼″	1.660	1.272	5/16″	.188″	**1.625**	**1.249**	2½″	2.875	1.755	9/16″	.563″	2.875	1.750
1½″	1.900	1.610	9	.148″	**1.875**	**1.579**	1½″	1.900	1.494	6	.203″	**1.875**	**1.469**	3″	3.500	2.284	19/32″	.594″	3.500	2.312
2″	2.375	2.067	5/32″	.156″	**2.375**	**2.063**	2″	2.375	1.933	5	.220″	**2.375**	**1.935**	3½″	4.000	2.716	5/8″	.625″	4.000	2.750
2½″	2.875	2.467	6	.203″	**2.875**	**2.469**	2½″	2.875	2.315	9/32″	.281″	**2.875**	**2.313**	4″	4.5 0	3.136	11/16″	.688″	4.500	3.125
3″	3.500	3.066	7/32″	.219″	**3.500**	**3.062**	3″	3.500	2.892	5/16″	.313″	**3.500**	**2.874**							

Bold face type show standard stock sizes.

Light face type show special sizes that are made on order only.

Courtesy of Otis Elevator Co.

SHELBY COLD DRAWN SEAMLESS STEEL TUBES—ROUND

Weight in Pounds per Lineal Foot. Based on weight of 1 cubic inch of steel=0.2833 pound

Outside diam. inches	THICKNESS IN GAUGE AND FRACTIONS OF AN INCH																
	22 B.W.G	20 B.W.G	18 B.W.G	1/16	3/32	1/8	5/32	3/16	7/32	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
1/2	.141	.174	.236	.292	.407	.501	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5/8	.179	.221	.301	.375	.532	.668	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3/4	.216	.267	.367	.459	.657	.834	.991	1.13	.....	.....	.....	.....	.....	.....	.....	.....	.....
7/8	.253	.314	.432	.542	.782	1.00	1.20	1.38	1.53	.....	.....	.....	.....	.....	.....	.....	.....
1	.291	.361	.498	.626	.907	1.17	1.41	1.63	1.83	2.00	.....	.....	.....	.....	.....	.....	.....
1 1/8	.328	.407	.563	.709	1.03	1.34	1.62	1.88	2.12	2.34	.....	.....	.....	.....	.....	.....	.....
1 1/4	.365	.454	.629	.793	1.16	1.50	1.83	2.13	2.41	2.67	3.13	3.50	.....	.....	.....	.....	.....
1 3/8	.....	.501	.694	.876	1.28	1.67	2.03	2.38	2.70	3.00	3.55	4.01	.....	.....	.....	.....	.....
1 1/2	.....	.548	.759	.960	1.41	1.84	2.24	2.63	2.99	3.34	3.96	4.51	5.34	.....	.....	.....	.....
1 3/4	.....	.....	.....	1.13	1.66	2.17	2.66	3.13	3.58	4.01	4.80	5.51	6.68	.....	.....	.....	.....
2	.....	.....	.....	1.29	1.91	2.50	3.08	3.63	4.16	4.67	5.63	6.51	8.01	9.18	.....	.....	.....
2 1/4	.....	.....	.....	1.46	2.16	2.84	3.49	4.13	4.75	5.34	6.47	7.51	9.35	10.85	.....	.....	.....
2 1/2	.....	.....	.....	1.63	2.41	3.17	3.91	4.63	5.33	6.01	7.30	8.51	10.68	12.52	.....	.....	.....
2 3/4	.....	.....	.....	1.79	2.66	3.50	4.33	5.13	5.91	6.68	8.14	9.51	12.02	14.18	.....	.....	.....
3	.....	.....	.....	.....	2.91	3.84	4.75	5.63	6.50	7.34	8.97	10.51	13.35	15.85	18.02	19.86	21.36
3 1/4	.....	.....	.....	.....	3.16	4.17	5.16	6.13	7.08	8.01	9.80	11.51	14.69	17.52	20.03	22.19	24.03
3 1/2	.....	.....	.....	.....	3.41	4.51	5.58	6.63	7.67	8.68	10.64	12.52	16.02	19.19	22.03	24.53	26.70
3 3/4	.....	.....	.....	.....	.....	4.84	6.00	7.13	8.25	9.35	11.47	13.52	17.36	20.86	24.03	26.87	29.37
4	.....	.....	.....	.....	.....	5.17	6.41	7.63	8.83	10.01	12.31	14.52	18.69	22.53	26.03	29.20	32.04
4 1/4	.....	.....	.....	.....	.....	.....	6.83	8.14	9.42	10.68	13.14	15.52	20.03	24.20	28.04	31.54	34.71
4 1/2	.....	.....	.....	.....	.....	.....	7.25	8.64	10.00	11.35	13.98	16.52	21.36	25.87	30.04	33.88	37.38
4 3/4	.....	.....	.....	.....	.....	.....	7.67	9.14	10.59	12.02	14.81	17.52	22.70	27.53	32.04	36.21	40.05
5	.....	.....	.....	.....	.....	.....	8.08	9.64	11.17	12.68	15.64	18.52	24.03	29.20	34.04	38.55	42.72
5 1/4	.....	.....	.....	.....	.....	.....	8.50	10.14	11.75	13.35	16.48	19.52	25.37	30.87	36.05	40.88	45.39
5 1/2	.....	.....	.....	.....	.....	.....	8 92	10.64	12.34	14.02	17.31	20.53	26.70	32.54	38.05	43.22	48.06
5 3/4	.....	.....	.....	.....	.....	.....	9.33	11.14	12.92	14 69	18.15	21.53	28.04	34.21	40.05	45.56	50.73
6	.....	.....	.....	.....	.....	.....	9.75	11.64	13.51	15.35	18.98	22.53	29.37	35.88	42.05	47.89	53.40

Tool Steel Tube

Seamless

This Tubing is made of high carbon tool steel, and will harden and take temper the same as bar tool steel. It is suitable for the manufacture of

Ball Bearings	Hollow Mills
Button Cutters	Hollow Tools
Cork Cutters	Roller Bearings
Hollow Cutters	Etc.

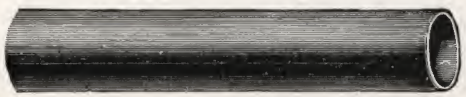
Tool Steel Tubes have proved of great advantage and convenience to manufacturers of hollow tools of various kinds.

Use Tool Steel Tubes and eliminate the large amount of drilling, machining, loss of time and waste of material that occur when making a tube from solid stock.

These Tubes are made from .65 to .70 carbon to sizes 1¼" O.D., and from .85 to .90 carbon in larger sizes. They will harden readily in oil or water. Almost any carbon can be furnished on orders in quantity.

We carry in stock all sizes up to 2½" O.D., with ⅜" wall; larger sizes will be added from time to time as the demand justifies.

For Price List, see page 82. Prices subject to discount.



SEAMLESS TOOL STEEL TUBING

Round. Price List—Per Foot—Subject to Discount.

Thickness B.W.G. and Fractions	OUTSIDE DIAMETER IN INCHES												
	½″	⅝″	¾″	⅞″	1″	1⅛″	1¼″	1⅜″	1½″	1⅝″	1¾″	1⅞″	2″
20 Gauge	.57	.63	.67	.70	.72	.....	.....	.....	.....	.....	.....	.....	.....
18 "	.57	.63	.67	.70	.72	.....	.....	.....	.....	.....	.....	.....	.....
16 "	.57	.63	.67	.70	.72	.77	.82	.87	.91	.....	.....	.....	.....
14 "	.57	.63	.67	.72	.79	.87	.91	.96	1.03	.....	.....	.....	.....
13 "	.57	.65	.72	.79	.87	.94	1.01	1.09	1.15	1.24	1.30	1.35	1.42
⅛″ Wall	.63	.72	.79	.87	.96	1.06	1.15	1.25	1.35	1.44	1.51	1.59	1.66
5/32″ "	.....	.....	.83	.94	1.06	1.18	1.30	1.42	1.54	1.66	1.77	1.85	1.93
3/16″ "	.....	.....	.87	1.01	1.15	1.30	1.44	1.59	1.73	1.87	2.02	2.11	2.21
¼″ "	.....	.....	.....	.....	1.34	1.54	1.73	1.92	2.12	2.30	2.45	2.59	2.74
5/16″ "	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.55	2.74	2.93	3.12
⅜″ "	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.93	3.12	3.31	3.55
½″ "	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.32
Outside Dia.		2⅛″	2¼″	2⅜″	2½″	2⅝″	2¾″	2⅞″	3″	3¼″	3½″	3¾″	4″
⅛″ Wall	.....	1.73	1.83	1.92	2.02	2.11	2.21	2.31	2.40	2.64	2.83	3.03	3.31
5/32″ "	.....	2.02	2.14	2.26	2.36	2.47	2.59	2.71	2.83	3.10	3.34	3.60	3.94
3/16″ "	.....	2.31	2.45	2.59	2.69	2.83	2.98	3.12	3.27	3.55	3.84	4.18	4.56
¼″ "	.....	2.88	3.07	3.26	3.46	3.60	3.75	3.89	4.03	4.32	4.61	5.14	5.62
5/16″ "	.....	3.36	3.60	3.84	4.03	4.23	4.42	4.61	4.80	5.19	5.57	6.05	6.63
⅜″ "	.....	3.79	4.03	4.27	4.51	4.75	4.99	5.23	5.47	5.95	6.43	7.01	7.59
½″ "	.....	4.61	4.90	5.19	5.47	5.76	6.05	6.34	6.63	7.20	7.78	8.35	8.93

TABLES
OF
USEFUL INFORMATION

Weights of Bar Steel—Per Foot

Size	Round	Square	Octagon	Size	Round	Square	Octagon
1/16	.010	.013	.011	2	10.68	13.60	11.29
1/8	.042	.053	.044	1/16	11.36	14.46	12.00
3/16	.094	.119	.099	1/8	12.06	15.35	12.74
1/4	.167	.212	.176	3/16	12.78	16.27	13.50
5/16	.261	.333	.276	1/4	13.52	17.22	14.29
3/8	.375	.478	.397	5/16	14.28	18.19	15.10
7/16	.511	.651	.540	3/8	15.07	19.18	15.92
1/2	.667	.850	.706	7/16	15.86	20.20	16.77
9/16	.845	1.076	.893	1/2	16.69	21.25	17.64
5/8	1.043	1.328	1.102	9/16	17.53	22.33	18.53
11/16	1.262	1.608	1.335	5/8	18.40	23.43	19.45
3/4	1.502	1.913	1.588	11/16	19.29	24.56	20.38
13/16	1.763	2.245	1.863	3/4	20.20	25.00	20.75
7/8	2.044	2.603	2.161	13/16	21.12	26.90	22.33
15/16	2.347	2.989	2.481	7/8	22.07	28.10	23.32
				15/16	23.04	29.34	24.35
1	2.670	3.400	2.822				
1/16	3.014	3.838	3.186	3	24.03	30.60	25.40
1/8	3.379	4.303	3.572	1/16	25.04	31.89	26.47
3/16	3.766	4.795	3.980	1/8	26.08	33.20	27.56
1/4	4.173	5.312	4.409	3/16	27.13	34.55	28.68
5/16	4.600	5.857	4.861	1/4	28.20	35.92	29.81
3/8	5.049	6.428	5.335	5/16	29.30	37.31	30.97
7/16	5.518	7.026	5.832	3/8	30.42	38.73	32.15
1/2	6.008	7.650	6.350	7/16	31.56	40.18	33.35
9/16	6.520	8.301	6.890	1/2	32.71	41.65	34.57
5/8	7.051	8.978	7.452	9/16	33.90	43.14	35.81
11/16	7.604	9.682	8.036	5/8	35.09	44.68	37.08
3/4	8.178	10.41	8.640	11/16	36.31	46.24	38.38
13/16	8.773	11.17	9.271	3/4	37.56	47.82	39.69
7/8	9.388	11.95	9.919	13/16	38.81	49.42	41.02
15/16	10.02	12.76	10.59	7/8	40.10	51.05	42 37

Weights of Bar Steel—Per Foot

Size	Round	Square	Octagon	Size	Round	Square	Octagon
3 15/16	41.40	52.71	43.75	6	96.14	122.4	101.6
				1/16	98.14	125.0	103.8
4	42.73	54.40	45.15	1/8	100.2	127.6	105.9
1/16	44.07	56.11	46.57	3/16	102.2	130.2	108.1
1/8	45.44	57.85	48.02	1/4	104.3	132.8	110.2
3/16	46.83	59.62	49.48	5/16	106.4	135.5	112.47
1/4	48.24	61.41	50.97	3/8	108.5	138.2	114.7
5/16	49.66	63.23	52.48	7/16	110.7	140.9	116.9
3/8	51.11	65.08	54.02	1/2	112.8	143.6	119.2
7/16	52.58	66.95	55.57	9/16	114.9	146.5	121.6
1/2	54.07	68.85	57.15	5/8	117.2	149.2	123.8
9/16	55.59	70.78	58.75	11/16	119.4	152.1	126.2
5/8	57.12	72.73	60.37	3/4	121.7	154.9	128.6
11/16	58.67	74.70	62.00	13/16	123.9	157.8	131.0
3/4	60.25	76.71	63.67	7/8	126.2	160.8	133.5
13/16	61.84	78.74	65.35	15/16	128.5	163.6	135.8
7/8	63.46	80.81	67.07				
15/16	65.10	82.89	68.80	7	130.9	166.6	138.3
				1/16	133.2	169.6	140.8
5	66.76	85.00	70.55	1/8	135.6	172.6	143.3
1/16	68.44	87.14	72.33	3/16	137.9	175.6	145.7
1/8	70.14	89.30	74.12	1/4	140.4	178.7	148.3
3/16	71.86	91.49	75.94	5/16	142.8	181.8	150.8
1/4	73.60	93.72	77.79	3/8	145.3	184.9	153.5
5/16	75.37	95.96	79.65	7/16	147.7	188.1	156.1
3/8	77.15	98.23	81.53	1/2	150.2	191.3	158.8
7/16	78.95	100.5	83.42	5/8	155.2	197.7	164.2
1/2	80.77	102.8	85.32	3/4	160.3	204.2	169.5
9/16	82.62	105.2	87.31	7/8	165.6	210.8	175.0
5/8	84.49	107.6	89.31	8	171.0	217.6	180.6
11/16	86.38	110.0	91.30	9	218.4	275.6	227.8
3/4	88.29	112.4	93.29	10	267.2	340.0	282.4
13/16	90.22	114.9	95.37	11	323.0	411.2	340.6
7/8	92.17	117.4	97.44	12	384.4	489.6	405.8
15/16	94 14	119.9	99.52				

Weights of Flat Bar Steel—Per Foot

	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	2	2¼	2½	2¾	3
1/16	.1060	.1381	.1594	.1859	.212	.2391	.2656	.292	.319	.346	.372	.425	.478	.531	.584	.638
⅛	.2125	.2656	.3188	.3720	.425	.4782	.5312	.585	.638	.692	.744	.850	.96	1.06	1.17	1.28
3/16	.319	.399	.478	.558	.638	.717	.797	.875	.957	1.04	1.15	1.28	1.44	1.59	1.75	1.91
¼	.425	.531	.636	.743	.850	.957	1.06	1.17	1.28	1.38	1.49	1.70	1.92	2.12	2.34	2.55
5/16	.531	.664	.797	.929	1.06	1.20	1.33	1.46	1.59	1.73	1.86	2.12	2.39	2.65	2.92	3.19
⅜	.638	.797	.957	1.116	1.28	1.43	1.59	1.76	1.92	2.08	2.23	2.55	2.87	3.19	3.51	3.83
7/16	.744	.929	1.116	1.302	1.49	1.68	1.86	2.05	2.23	2.42	2.60	2.98	3.35	3.72	4.09	4.46
½	.850	1.06	1.275	1.487	1.70	1.92	2.12	2.34	2.55	2.72	2.98	3.40	3.83	4.25	4.67	5.10
9/16	.957	1.20	1.434	1.674	1.92	2.15	2.39	2.63	2.87	3.11	3.35	3.83	4.30	4.78	5.26	5.74
⅝	1.06	1.33	1.594	1.859	2.12	2.39	2.65	2.92	3.19	3.46	3.72	4.25	4.78	5.31	5.84	6.38
11/16	1.17	1.46	1.753	2.045	2.34	2.63	2.92	3.22	3.51	3.80	4.09	4.67	5.26	5.84	6.43	7.02
¾	1.28	1.60	1.913	2.232	2.55	2.87	3.19	3.51	3.83	4.15	4.47	5.10	5.75	6.38	7.02	7.65
13/16	1.38	1.73	2.072	2.417	2.76	3.11	3.45	3.80	4.14	4.49	4.84	5.53	6.21	6.90	7.60	8.29
⅞	1.49	1.86	2.232	2.604	2.98	3.35	3.72	4.09	4.47	4.84	5.20	5.95	6.69	7.44	8.18	8.93
15/16	1.60	1.99	2.391	2.789	3.19	3.59	3.99	4.39	4.78	5.18	5.58	6.38	7.18	7.97	8.77	9.57
1	1.70	2.13	2.55	2.98	3.40	3.83	4.25	4.68	5.10	5.53	5.95	6.80	7.65	8.50	9.35	10.20
1 1/8	1.91	2.39	2.87	3.35	3.83	4.30	4.78	5.26	5.74	6.22	6.70	7.65	8.61	9.57	10.52	11.48
1 ¼	2.12	2.66	3.19	3.72	4.25	4.79	5.31	5.85	6.38	6.91	7.44	8.50	9.57	10.63	11.69	12.75
1 3/8	2.34	2.92	3.51	4.09	4.67	5.26	5.84	6.43	7.02	7.60	8.18	9.35	10.52	11.69	12.85	14.03
1 ½	2.55	3.19	3.83	4.47	5.10	5.74	6.38	7.02	7.65	8.29	8.93	10.20	11.48	12.75	14.03	15.30
1 5/8	2.76	3.45	4.15	4.84	5.52	6.22	6.90	7.60	8.29	8.98	9.67	11.05	12.43	13.81	15.19	16.58
1 ¾	2.98	3.72	4.47	5.21	5.95	6.70	7.44	8.19	8.93	9.67	10.42	11.90	13.40	14.88	16.37	17.85
1 7/8	3.19	3.99	4.79	5.58	6.38	7.17	7.97	8.77	9.57	10.36	11.15	12.75	14.34	15.94	17.53	19.13
2	3.40	4.25	5.10	5.95	6.80	7.65	8.50	9.35	10.20	11.05	11.90	13.60	15.30	17.00	18.70	20.40

Weights of Flat Bar Steel—Per Foot

	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼	6½	6¾	7
1/16	.691	.741	.80	.85	.90	.96	1.01	1.06	1.12	1.17	1.22	1.27	1.33	1.38	1.43	1.49
1/8	1.38	1.49	1.59	1.70	1.81	1.91	2.02	2.13	2.23	2.34	2.44	2.55	2.66	2.76	2.87	2.97
3/16	2.07	2.23	2.39	2.55	2.71	2.87	3.03	3.19	3.35	3.51	3.67	3.83	3.99	4.14	4.30	4.46
1/4	2.76	2.98	3.19	3.40	3.61	3.83	4.04	4.25	4.46	4.67	4.89	5.10	5.31	5.53	5.74	5.95
5/16	3.45	3.72	3.99	4.25	4.52	4.78	5.05	5.31	5.58	5.84	6.11	6.38	6.64	6.90	7.17	7.44
3/8	4.15	4.47	4.78	5.10	5.42	5.74	6.06	6.38	6.69	7.02	7.34	7.65	7.97	8.29	8.61	8.93
7/16	4.83	5.20	5.58	5.95	6.32	6.70	7.07	7.44	7.81	8.18	8.56	8.93	9.29	9.67	10.04	10.41
1/2	5.53	5.95	6.38	6.80	7.22	7.65	8.08	8.50	8.93	9.35	9.77	10.20	10.63	11.05	11.48	11.90
9/16	6.22	6.70	7.17	7.65	8.13	8.61	9.09	9.57	10.04	10.52	11.00	11.48	11.95	12.43	12.91	13.39
5/8	6.91	7.44	7.97	8.50	9.03	9.57	10.10	10.63	11.16	11.69	12.22	12.75	13.28	13.81	14.34	14.87
11/16	7.60	8.18	8.76	9.35	9.93	10.52	11.11	11.69	12.27	12.85	13.44	14.03	14.61	15.20	15.78	16.36
3/4	8.29	8.93	9.57	10.20	10.84	11.48	12.12	12.75	13.39	14.03	14.67	15.30	15.94	16.58	17.22	17.85
13/16	8.98	9.67	10.36	11.05	11.74	12.43	13.12	13.81	14.50	15.19	15.88	16.58	17.27	17.95	18.65	19.34
7/8	9.67	10.41	11.16	11.90	12.65	13.39	14.13	14.87	15.62	16.36	17.10	17.85	18.60	19.34	20.08	20.83
15/16	10.36	11.16	11.95	12.75	13.55	14.34	15.14	15.94	16.74	17.53	18.33	19.13	19.92	20.72	21.51	22.32
1	11.05	11.90	12.75	13.60	14.45	15.30	16.15	17.00	17.85	18.70	19.55	20.40	21.25	22.10	22.95	23.80
1 1/8	12.43	13.39	14.34	15.30	16.26	17.22	18.17	19.13	20.08	21.04	21.99	22.95	23.91	24.87	25.82	26.78
1 1/4	13.81	14.87	15.94	17.00	18.06	19.13	20.19	21.25	22.32	23.38	24.44	25.50	26.56	27.62	28.69	29.75
1 3/8	15.20	16.36	17.53	18.70	19.87	21.04	22.21	23.38	24.54	25.71	26.88	28.05	29.22	30.39	31.56	32.72
1 1/2	16.58	17.85	19.13	20.40	21.68	22.95	24.23	25.50	26.78	28.05	29.33	30.60	31.88	33.15	34.43	35.70
1 5/8	17.96	19.34	20.72	22.10	23.48	24.87	26.25	27.63	29.01	30.39	31.77	33.15	34.53	35.91	37.99	38.67
1 3/4	19.34	20.83	22.32	23.80	25.29	26.78	28.27	29.75	31.24	32.73	34.22	35.70	37.19	38.68	40.17	41.65
1 7/8	20.72	22.31	23.91	25.50	27.10	28.69	30.28	31.87	33.47	35.06	36.65	38.25	38.85	41.44	43.03	44.63
2	22.10	23.80	25.50	27.20	28.90	30.60	32.30	34.00	35.70	37.40	39.10	40.80	42.50	44.20	45.90	47.60

Table of Decimal Equivalents

Of Millimeters and Fractions of Millimeters

mm.	Inches.	mm.	Inches.	mm.	Inches.	mm.	Inches.
$\frac{1}{100}$	=.00039	$\frac{33}{100}$	=.01299	$\frac{64}{100}$	=.02520	$\frac{95}{100}$	=.03740
$\frac{2}{100}$	=.00079	$\frac{34}{100}$	=.01339	$\frac{65}{100}$	=.02559	$\frac{96}{100}$	=.03780
$\frac{3}{100}$	=.00118	$\frac{35}{100}$	=.01378	$\frac{66}{100}$	=.02598	$\frac{97}{100}$	=.03819
$\frac{4}{100}$	=.00157	$\frac{36}{100}$	=.01417	$\frac{67}{100}$	=.02638	$\frac{98}{100}$	=.03858
$\frac{5}{100}$	=.00197	$\frac{37}{100}$	=.01457	$\frac{68}{100}$	=.02677	$\frac{99}{100}$	=.03898
$\frac{6}{100}$	=.00236	$\frac{38}{100}$	=.01496	$\frac{69}{100}$	=.02717	1	=.03937
$\frac{7}{100}$	=.00276	$\frac{39}{100}$	=.01535	$\frac{70}{100}$	=.02756	2	=.07874
$\frac{8}{100}$	=.00315	$\frac{40}{100}$	=.01575	$\frac{71}{100}$	=.02795	3	=.11811
$\frac{9}{100}$	=.00354	$\frac{41}{100}$	=.01614	$\frac{72}{100}$	=.02835	4	=.15748
$\frac{10}{100}$	=.00394	$\frac{42}{100}$	=.01654	$\frac{73}{100}$	=.02874	5	=.19685
$\frac{11}{100}$	=.00433	$\frac{43}{100}$	=.01693	$\frac{74}{100}$	=.02913	6	=.23622
$\frac{12}{100}$	=.00472	$\frac{44}{100}$	=.01732	$\frac{75}{100}$	=.02953	7	=.27559
$\frac{13}{100}$	=.00512	$\frac{45}{100}$	=.01772	$\frac{76}{100}$	=.02992	8	=.31496
$\frac{14}{100}$	=.00551	$\frac{46}{100}$	=.01811	$\frac{77}{100}$	=.03032	9	=.35433
$\frac{15}{100}$	=.00591	$\frac{47}{100}$	=.01850	$\frac{78}{100}$	=.03071	10	=.39370
$\frac{16}{100}$	=.00630	$\frac{48}{100}$	=.01890	$\frac{79}{100}$	=.03110	11	=.43307
$\frac{17}{100}$	=.00669	$\frac{49}{100}$	=.01929	$\frac{80}{100}$	=.03150	12	=.47244
$\frac{18}{100}$	=.00709	$\frac{50}{100}$	=.01969	$\frac{81}{100}$	=.03189	13	=.51181
$\frac{19}{100}$	=.00748	$\frac{51}{100}$	=.02008	$\frac{82}{100}$	=.03228	14	=.55118
$\frac{20}{100}$	=.00787	$\frac{52}{100}$	=.02047	$\frac{83}{100}$	=.03268	15	=.59055
$\frac{21}{100}$	=.00827	$\frac{53}{100}$	=.02087	$\frac{84}{100}$	=.03307	16	=.62992
$\frac{22}{100}$	=.00866	$\frac{54}{100}$	=.02126	$\frac{85}{100}$	=.03346	17	=.66929
$\frac{23}{100}$	=.00906	$\frac{55}{100}$	=.02165	$\frac{86}{100}$	=.03386	18	=.70866
$\frac{24}{100}$	=.00945	$\frac{56}{100}$	=.02205	$\frac{87}{100}$	=.03425	19	=.74803
$\frac{25}{100}$	=.00984	$\frac{57}{100}$	=.02244	$\frac{88}{100}$	=.03465	20	=.78740
$\frac{26}{100}$	=.01024	$\frac{58}{100}$	=.02283	$\frac{89}{100}$	=.03504	21	=.82677
$\frac{27}{100}$	=.01063	$\frac{59}{100}$	=.02323	$\frac{90}{100}$	=.03543	22	=.86614
$\frac{28}{100}$	=.01102	$\frac{60}{100}$	=.02362	$\frac{91}{100}$	=.03583	23	=.90551
$\frac{29}{100}$	=.01142	$\frac{61}{100}$	=.02402	$\frac{92}{100}$	=.03622	24	=.94488
$\frac{30}{100}$	=.01181	$\frac{62}{100}$	=.02441	$\frac{93}{100}$	=.03661	25	=.98425
$\frac{31}{100}$	=.01220	$\frac{63}{100}$	=.02480	$\frac{94}{100}$	=.03701	26	=1.02362
$\frac{32}{100}$	=.01260						

Equivalent Temperatures, Centigrade to Fahrenheit

(Degrees Centigrade x 1.8) + 32 = Degrees Fahrenheit

$$\frac{\text{Degrees Fahrenheit} - 32}{1.8} = \text{Degrees Centigrade}$$

Cen.	Fahr.	Cen.	Fahr.	Cen.	Fahr.	Cen.	Fahr.	Cen.	Fahr.	Cen.	Fahr.	Cen.	Fahr.
100	212.	305	581.	510	950.	715	1319.	925	1697.	1135	2075.	1345	2453
105	221.	310	590.	515	959.	720	1328.	930	1706.	1140	2084.	1350	2462
110	230.	315	599.	520	968.	725	1337.	935	1715.	1145	2093.	1355	2471
115	239.	320	608.	525	977.	730	1346.	940	1724.	1150	2102.	1360	2480
120	248.	325	617.	530	986.	735	1355.	945	1733.	1155	2111.	1365	2489
125	257.	330	626.	535	995.	740	1364.	950	1742.	1160	2120.	1370	2498
130	266.	335	635.	540	1004.	745	1373.	955	1751.	1165	2129.	1375	2507
135	275.	340	644.	545	1013.	750	1382.	960	1760.	1170	2138.	1380	2516
140	284.	345	653.	550	1022.	755	1391.	965	1769.	1175	2147.	1385	2525
145	293.	350	662.	555	1031.	760	1400.	970	1778.	1180	2156.	1390	2534
150	302.	355	671.	560	1040.	765	1409.	975	1787.	1185	2165.	1395	2543
155	311.	360	680.	565	1049.	770	1418.	980	1796.	1190	2174.	1400	2552
160	320.	365	689.	570	1058.	775	1427.	985	1805.	1195	2183.	1405	2561
165	329.	370	698.	575	1067.	780	1436.	990	1814.	1200	2192.	1410	2570
170	338.	375	707.	580	1076.	785	1445.	995	1823.	1205	2201.	1415	2579
175	347.	380	716.	585	1085.	790	1454.	1000	1832.	1210	2210.	1420	2588
180	356.	385	725.	590	1094.	795	1463.	1005	1841.	1215	2219.	1425	2597
185	365.	390	734.	595	1103.	800	1472.	1010	1850.	1220	2228.	1430	2606
190	374.	395	743.	600	1112.	805	1481.	1015	1859.	1225	2237.	1435	2615
195	383.	400	752.	605	1121.	810	1490.	1020	1868.	1230	2246.	1440	2624
200	392.	405	761.	610	1130.	815	1499.	1025	1877.	1235	2255.	1445	2633
205	401.	410	770.	615	1139.	820	1508.	1030	1886.	1240	2264.	1450	2642
210	410.	415	779.	620	1148.	825	1517.	1035	1895.	1245	2273.	1455	2651
215	419.	420	788.	625	1157.	830	1526.	1040	1904.	1250	2282.	1460	2660
220	428.	425	797.	630	1166.	835	1535.	1045	1913.	1255	2291.	1465	2669
225	437.	430	806.	635	1175.	840	1544.	1050	1922.	1260	2300.	1470	2678
230	446.	435	815.	640	1184.	845	1553.	1055	1931.	1265	2309.	1475	2687
235	455.	440	824.	645	1193.	850	1562.	1060	1940.	1270	2318.	1480	2696
240	464.	445	833.	650	1202.	855	1571.	1065	1949.	1275	2327.	1485	2705
245	473.	450	842.	655	1211.	860	1580.	1070	1958.	1280	2336.	1490	2714
250	482.	455	851.	660	1220.	865	1589.	1075	1967.	1285	2345.	1495	2723
255	491.	460	860.	665	1229.	870	1598.	1080	1976.	1290	2354.	1500	2732
260	500.	465	869.	670	1238.	875	1607.	1085	1985.	1295	2363.	1505	2741
265	509.	470	878.	675	1247.	880	1616.	1090	1994.	1300	2372.	1510	2750
270	518.	475	887.	680	1256.	885	1625.	1095	2003.	1305	2381.	1515	2759
275	527.	480	896.	685	1265.	890	1634.	1100	2012.	1310	2390.	1520	2768
280	536.	485	905.	690	1274.	895	1643.	1105	2021.	1315	2399.	1525	2777
285	545.	490	914.	695	1283.	900	1652.	1110	2030.	1320	2408.	1530	2786
290	554.	495	923.	700	1292.	905	1661.	1115	2039.	1325	2417.	1535	2795
295	563.	500	932.	705	1301.	910	1670.	1120	2048.	1330	2426.	1540	2804
300	572.	505	941.	710	1310.	915	1679.	1125	2057.	1335	2435.	1545	2813
						920	1688.	1130	2066.	1340	2444.	1550	2822

Fractional Inches into Decimals and Millimeters

Inch	Decimal Inch	Millimeter	Inch	Decimal Inch	Millimeter
1/64	0.015625	0.3968	33/64	0.515625	13.0966
1/32	0.03125	0.7937	17/32	0.53125	13.4934
3/64	0.046875	1.1906	35/64	0.546875	13.8903
1/16	0.0625	1.5874	9/16	0.5625	14.2872
5/64	0.078125	1.9843	37/64	0.578125	14.6841
3/32	0.09375	2.3812	19/32	0.59375	15.0809
7/64	0.109375	2.7780	39/64	0.609375	15.4778
1/8	0.125	3.1749	5/8	0.625	15.8747
9/64	0.140625	3.5718	41/64	0.640625	16.2715
5/32	0.15625	3.9686	21/32	0.65625	16.6684
11/64	0.171875	4.3655	43/64	0.671875	17.0653
3/16	0.1875	4.7624	11/16	0.6875	17.4621
13/64	0.203125	5.1592	45/64	0.703125	17.8590
7/32	0.21875	5.5561	23/32	0.71875	18.2559
15/64	0.234375	5.9530	47/64	0.734375	18.6527
1/4	0.25	6.3498	3/4	0.75	19.0496
17/64	0.265625	6.7467	49/64	0.765625	19.4465
9/32	0.28125	7.1436	25/32	0.78125	19.8433
19/64	0.296875	7.5404	51/64	0.796875	20.2402
5/16	0.3125	7.9373	13/16	0.8125	20.6371
21/64	0.328125	8.3342	53/64	0.828125	21.0339
11/32	0.34375	8.7310	27/32	0.84375	21.4308
23/64	0.359375	9.1279	55/64	0.859375	21.8277
3/8	0.375	9.5248	7/8	0.875	22.2245
25/64	0.390625	9.9216	57/64	0.890625	22.6214
13/32	0.40625	10.3185	29/32	0.90625	23.0183
27/64	0.421875	10.7154	59/64	0.921875	23.4151
7/16	0.4375	11.1122	15/16	0.9375	23.8120
29/64	0.453125	11.5091	61/64	0.953125	24.2089
15/32	0.46875	11.9060	31/32	0.96875	24.6057
31/64	0.484375	12.3029	63/64	0.984375	25.0026
1/2	0.50	12.6997	1	1.00000	25.3995

Comparative Table of Gauges in Common Use

Dimensions of Sizes in Decimal Parts of an Inch

Number of Wire Gauge	American, or Brown & Sharpe	Birmingham, or Stubs' Iron Wire	Washburn & Moen, Worcester, Mass.	W. & M. Steel Music Wire	New American S. & W. Co's Music Wire Gauge	Imperial Wire Gauge	Stubs' Steel Wire	U. S. Standard Gauge for Sheet and Plate Iron and Steel
00000000	.....	.....	.....	.0083	.....	.....	.....	.....
0000000	.....	.....	.....	.0087	.....	.....	.....	.....
000000	.....	.....	.....	.0095	.004	.464	.....	.46875
00000	.....	.....	.....	.010	.005	.432	.....	.4375
0000	.460	.454	.3938	.011	.006	.400	.....	.40625
000	.40964	.425	.3625	.012	.007	.372	.....	.375
00	.3648	.380	.3310	.0133	.008	.348	.....	.34375
0	.32486	.340	.3065	.0144	.009	.324	.....	.3125
1	.2893	.300	.2830	.0156	.010	.300	.227	.28125
2	.25763	.284	.2625	.0166	.011	.276	.219	.265625
3	.22942	.259	.2437	.0178	.012	.252	.212	.250
4	.20431	.238	.2253	.0188	.013	.232	.207	.234375
5	.18194	.220	.2070	.0202	.014	.212	.204	.21875
6	.16202	.203	.1920	.0215	.016	.192	.201	.203125
7	.14428	.180	.1770	.023	.018	.176	.199	.1875
8	.12849	.165	.1620	.0243	.020	.160	.197	171875
9	.11443	.148	.1483	.0256	.022	.144	.194	.15625
10	.10189	.134	.1350	.027	.024	.128	.191	.140625
11	.090742	.120	.1205	.0284	.026	116	.188	.125
12	.080808	.109	.1055	.0296	.029	.104	.185	.109375
13	.071961	.095	.0915	.0314	.031	.092	.182	.09375
14	.064084	.083	.0800	.0326	.033	.080	.180	.078125
15	.057068	.072	.0720	.0345	.035	.072	.178	.0703125
16	.05082	.065	.0625	036	.037	.064	.175	.0625
17	.045257	.058	.0540	.0377	.039	.056	.172	.05625
18	.040303	.049	.0475	.0395	.041	.048	.168	.050
19	.03589	.042	.0410	.0414	.043	.040	.164	.04375
20	.031961	.035	.0348	.0434	.045	.036	.161	.0375
21	.028462	.032	.03175	.046	.047	.032	.157	.034375
22	.025347	.028	.0286	.0483	.049	.028	.155	.03125
23	.022571	.025	.0258	.051	.051	.024	.153	.028125
24	.0201	.022	.0230	.055	.055	.022	.151	.025
25	.0179	.020	.0204	.0586	.059	.020	148	.021875
26	.01594	.018	.0181	.0626	.063	.018	.146	.01875
27	.014195	.016	.0173	.0658	.067	.0164	.143	.0171875
28	.012641	.014	.0162	.072	.071	.0149	.139	.015625
29	.011257	.013	.0150	.076	.075	.0136	.134	.0140625
30	.010025	.012	.0140	.080	.080	.0124	.127	.0125
31	.008928	.010	.0132	.....	.085	.0116	.120	.0109375
32	.00795	.009	.0128	.....	.090	.0108	.115	.01015625
33	.00708	.008	.0118	.....	.095	.0100	.112	.009375
34	.006304	.007	.0104	.....	.....	.0092	.110	.00859375
35	.005614	.005	.0095	.....	.....	.0084	.108	.0078125
36	.005	.004	.0090	.....	.....	.0076	.106	.00703125
37	.004453	.....	.....	.....	.....	.0068	.103	.006640625
38	.003965	.....	.....	.....	.....	.0060	.101	.00625
39	.003531	.....	.....	.....	.....	.0052	.099	.....
40	.003144	.....	.....	.....	....	0048	.097	.. ..

Metric Conversion Table

Inches to Millimeters

39.37 inches, U. S. Standard = 1 meter = 100 centimeters = 1000 millimeters

Inches	0	1/16"	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"
0	0.00	1.59	3.18	4.76	6.35	7.94	9.53	11.11
1	25.40	26.99	28.58	30.16	31.75	33.34	34.93	36.51
2	50.80	52.39	53.98	55.56	57.15	58.74	60.33	61.91
3	76.20	77.79	79.38	80.96	82.55	84.14	85.73	87.31
4	101.60	103.19	104.78	106.36	107.95	109.54	111.13	112.71
5	127.00	128.59	130.18	131.76	133.35	134.94	136.53	138.11
6	152.40	153.99	155.58	157.16	158.75	160.34	161.93	163.51
7	177.80	179.39	180.98	182.56	184.15	185.74	187.33	188.91
8	203.20	204.79	206.38	207.96	209.55	211.14	212.73	214.31
9	228.60	230.19	231.78	233.36	234.95	236.54	238.13	239.71
10	254.00	255.59	257.18	258.76	260.35	261.94	263.53	265.11
11	279.40	280.99	282.58	284.16	285.75	287.34	288.93	290.51
Feet								
1	304.80	306.39	307.98	309.56	311.15	312.74	314.33	315.91
2	609.60	611.19	612.78	614.36	615.95	617.54	619.13	620.71
3	914.40	915.99	917.58	919.16	920.75	922.34	923.93	925.51
4	1219.20	1220.79	1222.38	1223.96	1225.55	1227.14	1228.73	1230.31
5	1524.00	1525.59	1527.18	1528.76	1530.35	1531.94	1533.53	1535.11
6	1828.80	1830.39	1831.98	1833.56	1835.15	1836.74	1838.33	1839.91
7	2133.60	2135.19	2136.78	2138.36	2139.95	2141.54	2143.13	2144.71
8	2438.40	2439.99	2441.58	2443.16	2444.75	2446.34	2447.93	2449.51
9	2743.20	2744.79	2746.38	2747.96	2749.55	2751.14	2752.73	2754.31
10	3048.00	3049.59	3051.18	3052.76	3054.35	3055.94	3057.53	3059.11

Metric Conversion Table

Inches to Millimeters

39.37 inches, U. S. Standard = 1 meter = 100 centimeters = 1000 millimeters

Inches	1/16"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"	15/16"
0	12.70	14.29	15.88	17.46	19.05	20.64	22.23	23.81
1	38.10	39.69	41.28	42.86	44.45	46.04	47.63	49.21
2	63.50	65.09	66.68	68.26	69.85	71.44	73.03	74.61
3	88.90	90.49	92.08	93.66	95.25	96.84	98.43	100.01
4	114.30	115.89	117.48	119.06	120.65	122.24	123.83	125.41
5	139.70	141.29	142.88	144.46	146.05	147.64	149.23	150.81
6	165.10	166.69	168.28	169.86	171.45	173.04	174.63	176.21
7	190.50	192.09	193.68	195.26	196.85	198.44	200.03	201.61
8	215.90	217.49	219.08	220.66	222.25	223.84	225.43	227.01
9	241.30	242.89	244.48	246.06	247.65	249.24	250.83	252.41
10	266.70	268.29	269.88	271.46	273.05	274.64	276.23	277.81
11	292.10	293.69	295.28	296.86	298.45	300.04	301.63	303.21
Feet								
1	317.50	319.09	320.68	322.26	323.85	325.44	327.03	328.61
2	622.30	623.89	625.48	627.06	628.65	630.24	631.83	633.41
3	927.10	928.69	930.28	931.86	933.45	935.04	936.63	938.21
4	1231.90	1233.49	1235.08	1236.66	1238.25	1239.84	1241.43	1243.01
5	1536.70	1538.29	1539.88	1541.46	1543.05	1544.64	1546.23	1547.81
6	1841.50	1843.09	1844.68	1846.26	1847.85	1849.44	1851.03	1852.61
7	2146.30	2147.89	2149.48	2151.06	2152.65	2154.24	2155.83	2157.41
8	2451.10	2452.69	2454.28	2455.86	2457.45	2459.04	2460.63	2462.21
9	2755.90	2757.49	2759.08	2760.66	2762.25	2763.84	2765.43	2767.01
10	3060.70	3062.29	3063.88	3065.46	3067.05	3068.64	3070.23	3071.81

INDEX

INDEX—Continued

INDEX—Continued

INDEX—Continued

INDEX—Continued